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Agriculture

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HER MAJESTY'S STATIONERY OFFICE

I.C.I. FERTILIZER AND MANAGEMENT NOTES

The Weather

February 'fill-dyke', usually regarded as our wettest, is in reality one of the drier months of the year.

Indeed, in the South of England, in three or four sunny days towards the end of the month the soil often dries sufficiently for spring wheat or oats to be sown. It is an opportunity well worth seizing.

Early Grass

In the South, February is the favourite month for applying nitrogen to grass to produce an "early bite". The standard application is now 3 cwt. per acre of Sulphate of Ammonia or 4 cwt. per acre 'Nitro-Chalk'.

The fields will have been selected and prepared by liming and applying phosphate and potash the previous autumn.

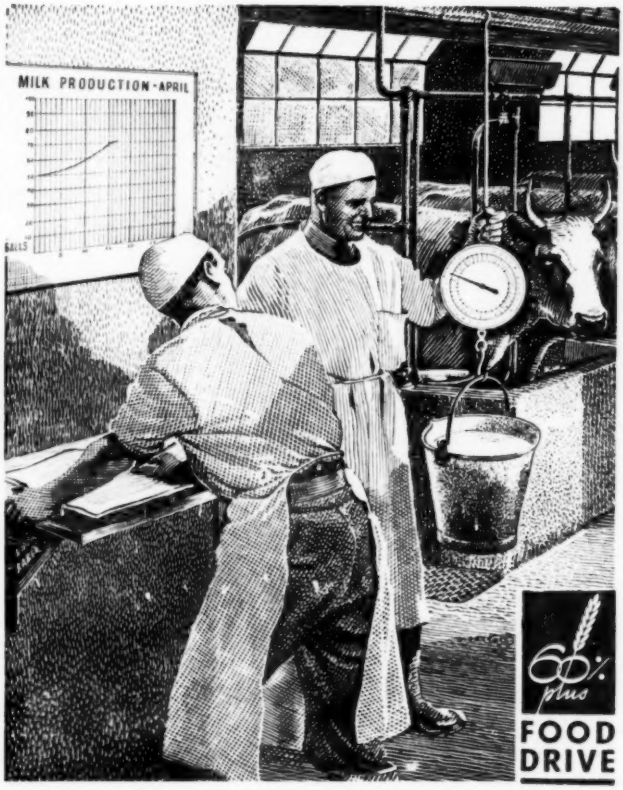
Electric Fence

It is a wise move also to have a look at the electric accumulator and pulsator, which have been in store, in preparation for re-erecting the electric fence. Enough fence posts, insulators and wire, too, will have to be ordered. A very useful adjunct to controlled grazing is a water trough with wheels at one end and a handle at the other — and sufficient 'Alkathene' tubing to connect it with a mains supply.

Top-dressing Cereals

Walk the winter cereals and keep an eye out for rabbit damage — and crops that have had a struggle to survive adverse conditions. Two cwt. per acre Sulphate of Ammonia applied in February will be their salvation. The way such crops can recover, if given nitrogen, is amazing, and a bag an acre of fertilizer is much cheaper than re-cultivation and re-seeding.

It is not only the damaged crops which can do with nitrogen — an application of Sulphate of Ammonia should be a routine at this time of the year to all autumn-sown cereals.



The Evidence Grows

Experience has shown that, given reasonable weather, February is *the* month for applying nitrogenous fertilizers to obtain early grass.

The recommended rate for land in good heart, and for Italian or H.I. Ryegrass leys, is 3 cwt. of Sulphate of Ammonia or 4 cwt. of 'Nitro-Chalk' per acre.

Year by year there is increasing evidence that herd costs are reduced and more milk than ever before is produced in April from grass.

In *Radnorshire*, for example, 10 acres of H.I. have supported 25 cows from 1st April. This field was given 3 cwt. of 'Nitro-Chalk' per acre.

In *Leicestershire*, 12 acres of Cocksfoot/Ryegrass in its second year received 4 cwt. 'Nitro-Chalk' per acre on 22nd February. Grazing with 70 cows started on 15th April and continued until 7th May, during which time the milk yield totalled 3,850 gallons. The grass alone produced 213 gallons per acre in this first grazing. Here is evidence in pail and pocket that no dairy farmer can afford to neglect.

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MYXOMATOSIS OF RABBITS

HARRY V. THOMPSON

Infestation Control Division, Ministry of Agriculture and Fisheries

The depletion of the rabbit population in Australia by the virus disease myxomatosis resulted in an increase in agricultural production of £50 million in 1952–53. Mr. Thompson here considers the prospects for the disease in the United Kingdom in the light of its history and behaviour elsewhere.

A RAPIDLY spreading disease with a mortality rate of almost 100 per cent is dramatic, and the rabbit is an animal with which we are all too familiar. It is not surprising, therefore, that the popular, farming and scientific press have shown considerable interest in the virus disease myxomatosis since it was first reported in January 1951 to have killed large numbers of rabbits in Australia. Previous attempts to introduce the virus into Australia and Europe had failed, and the Australian scientists were themselves surprised by the extent of the epizootic (temporarily prevalent outbreak of disease) they had produced. It had covered an area of over a million square miles by mid-1951 and killed tens of millions of rabbits.

Suggestions that myxomatosis should be introduced into Britain were soon forthcoming, but the conditions here are very different from those in Australia; it was not known whether suitable carriers occurred here, nor whether the disease would provide a permanent form of control, nor was it desired to endanger stocks of domestic rabbits without this certainty. Furthermore, the symptoms of the disease are very distressing, being characterized by an intense swelling and inflammation of the eyelids, which spreads towards the forehead and ears and may also affect the genital region.

It came as a surprise to learn in early 1953 that myxomatosis had been introduced into France the year before and was sweeping across the country. That the disease should cross the Channel was inevitable, but it did not manage to do so until the autumn of 1953, when the first outbreak occurred near Edenbridge in Kent. An Advisory Committee was appointed by the Minister of Agriculture and Secretary of State for Scotland and, to give the Committee time to consider the problem objectively, a determined attempt was made to prevent the spread of infection by destroying the rabbits in the Edenbridge area. Similar action was taken with the next four outbreaks but, when further outbreaks were confirmed at widely separated places, the Advisory Committee came to the conclusion that the action taken to control the initial outbreaks could no longer effectively influence the course of the disease.

Before taking the story any further, let us look into the history of the disease and its behaviour in other countries. Myxomatosis was first reported in 1898 from Montevideo, Uruguay, where a stock of laboratory rabbits (*Oryctolagus cuniculus*) was almost wiped out by it. The laboratory rabbit is the domestic form of the wild European rabbit and was introduced into South America by the Spaniards. Outbreaks of myxomatosis subsequently occurred among domestic rabbits in Argentina, Brazil and southern California, and many rabbitries were completely depopulated. Virologists have been much interested in myxomatosis, and in laboratory experiments the mortality rate has consistently been 99.5 per cent or higher. The origin of the disease was unknown until 1942, when it was found that many of the tapetis or native wild rabbits of Brazil (*Sylvilagus brasiliensis*) showed acquired immunity to the infection; non-immune tapetis reacted to intradermal inoculation of the virus by developing a mild form of myxomatosis with virtually no generalization and no mortality. Mosquitoes and a cat flea were found to transmit the virus both to other tapetis and to laboratory rabbits.

Biological Control is Attractive Most methods of pest control are laborious and expensive, and the use of an animal or a microbe to destroy a pest is attractive. There are many examples of successful biological control of plant and insect pests, one of the best known being that of prickly pears in Australia by an Argentine moth (*Cactoblastis cactorum*), but biological control of vertebrate pests has met with very limited success, although frequently used against small rodents. To be effective, an agent of biological control must be specific to the pest population and spread rapidly through it. The myxoma virus fulfils the first of these conditions admirably, for extensive laboratory experiments by workers in America, Europe and Australia have shown that it causes disease only in the European rabbit: the common domesticated mammals and birds, as well as various Australian birds and marsupials, have all been found to be refractory. The Australian and French epizootics may be regarded as large-scale field experiments, and it is notable that, other than the European rabbit, the only animals known to have been affected have been three hares in France. Despite rumours to the contrary, there is no evidence that man can be affected by myxomatosis.

That the virus should cause a highly lethal disease in one species of animal only is remarkable and calls for comment. It has been suggested that just as *Sylvilagus* is the New World equivalent of *Oryctolagus*, so is myxoma virus the New World representative of the pox viruses; a hypothesis which is supported by the similar pathogenesis of myxomatosis and the pox diseases and the similarity between the elementary bodies of myxoma and vaccinia (cow pox) viruses in the electron microscope. In *Sylvilagus*, through long association, myxomatosis is a mild disease, which indicates a stabilized host-parasite relationship; but when the disease is transmitted from a *Sylvilagus* to an *Oryctolagus*, the latter has no defences against it and, with rare exceptions, becomes fatally ill. No biological association on a basis of 99.5 per cent lethality could endure for long, and, as we shall see later, some host-parasite adjustment is almost inevitable.

The second essential condition for biological control – that the controlling agent should spread rapidly through the pest population – was not at first fulfilled by the myxoma virus, although it has been recently in Australia and France. Some consideration of the various attempts to introduce myxomatosis into Europe and Australia will make this clear.

Early Attempts to Introduce Myxomatosis It is well known that rabbits from Britain were successfully introduced into Australasia in the early and mid-nineteenth century and, with an abundant food supply and a relative absence of predators, rapidly became a pest. The Australian rabbit population in 1950 was thought to be somewhere between 1,000 and 3,000 million, and it has frequently been stated that its elimination would be the greatest single step towards increased food and wool production. As early as 1926, it was suggested that myxomatosis might be used to control the rabbit in Australia, and laboratory studies were followed by experiments in outdoor cages at Cambridge to determine the facility with which the virus would spread through populations kept under almost natural conditions. The results of these tests, in which the disease was spread mostly by contact between infected and healthy rabbits, were most encouraging, and the tests were followed by extensive colony and field experiments in Australia from 1936 to 1943. Favourable results were obtained when the rabbits were infested with the native stickfast flea, which had been proved in the laboratory to be a carrier of the disease, and when predators were few. The most important trials, however, were done in semi-arid pastoral areas, partly because rabbit control by normal methods is uneconomic in such regions, and also because the health authorities maintained a cautious attitude towards the host-specificity of the virus. These trials met with only limited success, owing to the failure of the disease to spread from one warren to another, partly due to foxes killing the slowly-moving, infected rabbits. Meanwhile, in Europe, three attempts were made in 1936–38 to introduce myxomatosis into a dense rabbit population on the Island of Skokholm, off the coast of Pembrokeshire. The disease spread a little, but had no controlling effect on the rabbits and soon died out. Attempts to introduce the virus on to a Danish island in the Kattegat and an estate in Sweden, made at the same time, met with only limited success.

The Great Australian Epizootic A re-examination of the possibilities of myxomatosis after the end of the war led to seven liberations of the virus being made between May and November 1950 at five sites in the Murray Valley. Six of the seven liberations apparently failed to take, and this was beginning to look like another fruitless experiment when, on December 10, 1950, rabbits were reported to be dying in hundreds along the river near the seventh site. Until this outbreak, the importance of mosquitoes as carriers of the disease had not been fully realized and, now, for the first time, the virus and its unconscious agents were brought together under suitable conditions. The spread of the disease was a reflection of the movements of infected mosquitoes and was dominated by the Murray-Darling river systems. Hundreds of thousands of acres in the well-watered areas were cleared of rabbits.

This first epizootic passed its peak in February 1951 and became quiescent in the following autumn and winter, when mosquitoes are scarce and infection is principally maintained by fleas, mites and other ectoparasites. The spring of 1951 and the summer of 1951–52 were dry, especially in Queensland, where the virus did not take hold. High rabbit mortality occurred, however, in Victoria and New South Wales—myxomatosis being transmitted by different species of mosquitoes from those of the previous year—for a distance of several miles on either side of the Murray River, compared with a few hundred yards in 1950–51. The season of 1952–53 was exceptionally favourable for the breeding of mosquitoes and other insect carriers and, for the third year in succession, millions of rabbits were killed by myxomatosis

in south-eastern Australia. It is estimated that four-fifths of the rabbits in this area have died and that there has been a substantial increase in rural production as a result. For 1952–53 alone, the increase is valued at £50 million, of which the all-time record wool clip and increase in numbers of sheep and lambs accounts for some £34 million.

A great deal of research has now been done by biologists in Australia, and it has been proved that the transmission of myxomatosis by insects is a purely mechanical process, there being no biological cycle within the insect, whose mouth parts act merely as a pin. In fact, the virus can be transmitted by sticking a pin into a lesion on an infected rabbit and then pricking a healthy one. Such a pin can remain infective for as long as twelve days, while a mosquito's proboscis may be infective for twenty-five days.

The mortality rate, particularly in the first year of the epizootic, approached the 99.5 per cent that was anticipated from laboratory studies, but the kill has not always been as high as this. A few areas showing high mortality in 1950-51 had disappointing results in 1951–52 and 1952–53, and it is thought that there has been a reduction in the mortality rate from 99.5 to about 92 per cent. This means that, allowing for the persistence of recovered, immune animals from one epizootic to the next, the overall kill will be about 85 per cent or less. This is the beginning of the process of host-parasite adjustment referred to earlier and can be due either to an attenuation of the virus, an increase in the innate resistance of the rabbit, or the "passive-resistance" of young rabbits having maternal antibodies acquired during gestation or lactation. According to press reports, Australian workers are developing mutants of the myxoma virus in an attempt to deal with residual rabbits which are immune to the present strain.

The French Outbreak No less dramatic than the 1950 outbreak in Australia was that in 1952 in France. In June of that year a retired doctor obtained some myxoma virus from a colleague in Switzerland, caught two rabbits from his estate in the department of Eure et Loire, near Paris, inoculated them with virus, and released them in his walled park. After a week, sick rabbits were seen, and in a month most of his wild rabbits had died. He did not intend or expect the disease to spread outside his park but, whether by insects or other means, it soon did so. Wild rabbits in the surrounding districts died and, within a month, domestic rabbits were also catching myxomatosis. The disease spread rapidly to other Departments, unconsciously assisted no doubt by the rabbit hunters' practice of taking rabbits from the north of France to the south to increase local stocks for subsequent shooting.

French workers are of the opinion that mosquitoes have not played a large part in spreading myxomatosis in their country and adduce circumstantial evidence to suggest that contaminated grass and fodder and the tyres of vehicles that have passed over myxomatous rabbits may have spread the disease. It seems likely, however, that mosquitoes or other biting insects played a key role as carriers in France as they did in Australia, and research is needed on the subject. Despite the efforts of the French authorities to stamp out the disease, it had spread by the end of 1953 to every Department of France, except the three in western Brittany, and also to Belgium, Luxembourg, Germany, the Netherlands, and Spain.

Myxomatosis in Britain After the unsuccessful experiments on Skokholm in 1936–38, no further attempts were made to introduce the myxoma virus until 1952, when experiments were carried out on

an uninhabited island in the Hebrides. Conclusive results have not yet been obtained from this work. No official effort has ever been made to introduce myxomatosis on to the mainland of Britain for the reasons outlined at the beginning of this article. Since myxomatosis has spread rapidly over Europe, it is evident that suitable carriers are available here, even though the species of insects responsible for the spread in Australia are not present. The first myxomatous infection of wild rabbits in England must have occurred some time in September 1953, and an outbreak at Bough Beech, near Edenbridge, Kent, was confirmed on October 13. It is not known how the virus was brought into the country. A second outbreak was confirmed a fortnight later near Robertsbridge in East Sussex. In pursuance of the Minister's policy, the centre of infection in both areas was wired with rabbit-proof netting and as far as possible all rabbits within the netting were killed. Since the beginning of November, six further outbreaks have been confirmed as follows:

Alciston, East Sussex	November 2
Sevenoaks, Kent	November 20
St. Osyth, Essex	November 27
Southwold, East Suffolk	December 2
Holland-on-Sea, Essex	December 5
Lydd, Kent	December 5
Faversham, Kent	January 4

It was quite impracticable for one reason or another to wire in the affected rabbits in most of these outbreaks, and it became clear that the destruction of rabbits by gassing and other means in these areas was unlikely to succeed in stamping out the disease in this country. It was even possible that drastic thinning of the population, by slowing down the rate of infection, might actually assist the disease to overwinter.

This seems an appropriate point to review the possible future of myxomatosis in Great Britain. Rabbits are a major pest and do a great deal of damage to crops of all kinds, for which the value of their carcass meat and fur does not compensate. To say that the losses due to rabbits are equivalent to 4–5 per cent of our gross agricultural output would be a fairly conservative estimate, and this represents a sum of £40–£50 million a year at current prices. The disease has not been officially introduced because it is impossible to know whether it will provide a permanent form of rabbit control, and anyone who is acquainted with its symptoms will not relish the prospect of British roads and countryside being strewn with blind and lethargic rabbits suffering a death which, though it may be no more painful than being trapped, is most unpleasant to witness.

Despite the spectacular reduction in rabbit numbers in France and eastern Australia, the increasing number of immune rabbits in the latter country indicates that the Australians may have by no means seen the last of their rabbit problem. Although introductions of myxomatosis into Tasmania and New Zealand have met with local successes, there have been no epizootics, and it seems probable that they will only occur when the climatic conditions establish a favourable host-carrier relationship. Nevertheless, we now have the virus in this country and it is hoped that, before next spring, research will be initiated into the means of transmission. Work is proceeding at the Ministry's veterinary laboratories on the preparation of vaccines for the protection of tame rabbits. At present the only practical method of vaccinating rabbits against myxomatosis is by the inoculation of another virus, the fibroma virus. The fibroma is closely related to myxoma and much work has been done with it since its discovery in the United States cottontail rabbit in 1932. Unlike myxoma, fibroma induces a benign disease

in both American and European rabbits, causing only a local tumour, and conferring protection against myxoma for at least six months. The screening of rabbit hutches against insects, and the use of insecticides is strongly recommended.

During the winter myxomatosis is likely to become quiescent and may even die out, since sylvan mosquitoes which bite rabbits overwinter only as eggs or larvae, and there may be too few infected rabbits for other carriers to maintain the disease. In any event, it is quite likely to be reintroduced from France; hence a myxomatosis epizootic in this country next spring is a strong possibility. Clearly, a full-scale epizootic in Britain would reduce rabbit numbers to a very low level, but the rapid breeding of survivors would make essential intensive control of every sort, accompanied by scrub clearance and other land improvement measures to maintain the position. Some equilibrium between virus and rabbit is sure to be established eventually, but the end result may well be a smaller rabbit population.

ACCENT ON PRODUCTIVITY

MEASURING BUSINESS EFFICIENCY ON THE FARM

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This is the second article in the series *Accent on Productivity*, which was introduced last month by Mr. A. N. Duckham's article on the role of farm measurement. In the March issue Mr. R. N. Dixey will discuss the economic aspects of the question.

THE main purpose of a business is to provide the best possible income for those to whom it belongs from the resources available to them in the form of capital, skill and, in the case of the farmer, land. The term " business efficiency ", as applied to farming, can therefore be taken to mean the effectiveness with which the farmer achieves this objective. Clearly then, the best general measure of the business efficiency of a farm is profit—profit, that is to say, over a considerable period of years, for seasons are too variable to base one's assessment on any single year, and maximum profit, even for several years, may in the long run impoverish both land and farmer.

But if the measurement of business efficiency is to have practical value—as a means of promoting better management, for example—it is necessary to go beyond a mere general assessment. A medical examination which merely established the fact that the organism was running " below par " would result in little more than a feeling of apprehension in the patient's mind. He wants to be told what part of the body is ailing and how to put it right. Similarly, there is little point in a measurement of business efficiency on the farm unless attention is directed to those aspects of management in which efficiency is low. What is wanted is not only an overall assessment, but also a system of analysis of the farm business which pin points weak spots. Can such a system be devised?

Formulating a Simple System Recent developments have brought this question very much into prominence. Because of the rapidly increasing demand by farmers for advice on problems of farm organization, a scheme is now being developed for collaboration between agricultural economists and the National Agricultural Advisory Service in giving such advice.

In connection with this scheme, the Agricultural Economics Department of Reading University has been attempting during the past three or four years to work out, from the considerable volume of farm economic data that has been collected over the years, a simple system of economic analysis based on the rough-and-ready physical and financial data which are all that can be obtained on most farms. Such a system can be of use to the agricultural advisory officer faced with the task of guiding farmers towards more profitable management. While space obviously does not permit of any detailed exposition of the methods used, the approach can be broadly indicated. The basic requirements for this system of analysis are:

(*a*) A measurement of farm output which, for practical purposes, can only be in cash terms.

(*b*) A statement of total expenditure per unit of output (e.g., per £100 cash output) broken down into the main components, e.g., rent, fertilizers, labour, etc.

For comparative purposes, cash output can be expressed per acre, per man or per unit of capital. In present circumstances, output per acre is perhaps the most useful measurement, for the simple reason that most farmers cannot easily change the size of their farm. But in farming, as in other industries, size of business has an important bearing on total profit. So for most farmers increasing size of business means increasing output per acre. Moreover, the burden of overhead charges is in these days very heavy and many such charges on the farm are closely related to acreage; so here again, expanding output per acre tends to increase profit by spreading the burden on overheads over a bigger turnover.

We next want to know what factors have determined the level of output achieved, be it high or low, and their relative contribution to the final result. Broadly speaking, output depends firstly on what you grow—that is, on the *intensity* of your cropping and stocking policy, and, secondly, on how well you grow it—that is, on *yield* per acre or per animal. It is possible to measure the relative intensity of a farming system by means of a composite "index of intensity". This is based on the gross cash output by value to be expected from the total acreage of crops grown and livestock kept, given normal yields. An investigation carried out at Reading University covering the years 1946–49 showed a considerable correlation between the degree of intensity, as measured by this kind of index, and farm profit. Out of a total of 287 farm accounts investigated, the profit per acre increased from about 5s. on 64 farms with indices of less than 85 to 67s. on 62 farms with indices of over 115.

The second main factor influencing output is the "yield" obtained from the various units contributing to total output—for example, the yields per acre of crops, the yields of milk or of other livestock produce per head of stock. Whereas output variations due to differences in the intensity of the farming system are matters of organization, those resulting from differences in yield are largely matters of technique. Again, it has been found possible to devise an "index of yields" to measure the overall level of yields being attained on a particular farm. The basis of this index is a comparison between

actual overall output from the whole combination of productive enterprises and output from that combination at normal yields.

The Farming System and the Farmer's Technique It will be seen that the use of these two indices will give the answer to two basic questions, each of which has an important bearing on business efficiency: (1) What is the total gross output of which this particular farm organization is capable, given normal technical efficiency?, and (2) How does the actual output being achieved compare with that normally to be expected from the existing organization?

The answer to the first question tells us something about the general system of farming employed: that to the second something about the farmer's technique; and according to the answers to these questions, a more detailed investigation of the standard of management can then be directed along the most appropriate channels.

Of course, a farming system of low intensity will not necessarily result in low profit—there are plenty of farms that are "extensive" and at the same time profitable. But where a low intensity and a low profit exist on the same farm, it is at least worth while inquiring whether there is any causal connection between them. For the further pursuit of such inquiry a number of subsidiary indices have been devised, aimed at locating the particular directions in which intensification is possible; for example, an index of intensity of land use, an index of density of stocking, a measurement of food acreage utilized per unit of livestock. The use of these indices must ultimately lead to the consideration of the possible practical changes in the farming organization; for example, more potatoes or sugar beet, a bigger dairy herd, a subsidiary enterprise such as pigs or poultry, and so on. The probable effects of such changes on the efficiency of the business (that is, on profits) can be roughly estimated by the process of farm budgeting which has been widely developed in the United States.

The other group of factors determining farm output (that is, those included within the general term "yield") reflect the farmer's technical efficiency. Without in any way underrating the significance of good organization in determining the efficiency of a farm business, all experience seems to confirm that this yield factor is still as important as any. The best business results generally emerge from a combination of good organization and technical efficiency reflected in high yields, and indeed the two are often closely interrelated.

Where the general level of yields on a farm is found to be low, one would seek to apply to each productive enterprise the appropriate technical efficiency tests. Unfortunately, many farmers lack the necessary records to enable these tests to be applied. Milk records are widely used, though it is surprising how misleading official records can be as an indication of the real average yield for a whole herd. But such records as those of egg yields, rates of liveweight gain by fat stock generally, average litter numbers and weights for pigs, and even yields of such crops as cereals, are sadly deficient. It is difficult to see how business efficiency can be measured without these records, and indeed their very absence is in itself sufficient to place the farm concerned some way down the efficiency scale.

Production Costs So far we have been glancing at efficiency measurements on the output side of the business. But that is only one half of the picture. It is not only a question of producing food, but of

finding the most economical way of producing it. Here, the most informative kind of statement is a table showing the cost of each main input per unit (say, per £100) of output. Farm output is the product of the whole combination of resources used, and a table of this kind shows not only the amounts of each input used, but the proportions in which they have been combined.

By itself, however, such a table does not necessarily give a true indication of the efficiency of use of the farm's resources themselves. For example, on a dairy farm, if the cost of labour per £100 worth of milk produced is unduly high, this may be due either to wasteful use of labour in the cowshed or to a poor average milk yield per cow, or both. In the latter case, an increase in average milk yield would reduce labour cost per gallon, but this would not imply any improvement in labour efficiency. What is wanted, to give a true test of efficient use of farm resources, is some method of comparing the amount of labour, materials, capital, etc., used with the amount required, under normal conditions, for the task to be performed.

An efficiency measurement of this sort has, in fact, been devised for farm labour. This is what is known as the "work-unit" system. An account of this was given by Sturrock at Cambridge in a paper on "The Productivity of Labour in Agriculture" read to the Agricultural Economics Society in July 1950. The basis of it is a list of normal labour requirements, expressed in work units per annum, for each of the main farm crops and livestock, one work unit being the amount of work normally done in an 8-hour day by an adult male worker. These figures are computed from crop and livestock enterprise studies. From them, estimates can be made of the theoretical amount of work necessary for a particular farm, using the actual crop acreages and stock numbers on the farm. The following is an example of how this system can be used to work out the labour efficiency of a particular farm:

	Crop Acreage or Stock Numbers		Normal Labour Requirements in days per acre or per head of stock		Work Units
	acres				
Cereals	30	×	4		120
Kale	7	×	20		140
Hay	35	×	3		105
	Numbers				
Cows	16	×	20		320
Young cattle	18	×	4		72
Sheep	70	×	1		70
				Total	**827**

Average number of men 2.5*
Work units per man = 827 ÷ 2·5 = 330

*2 for part of year, 3 for remainder

A normal figure, based on a considerable sample of farms, is 270 work units per man, so that in this case labour efficiency is abour 20 per cent above normal. It will be appreciated that this method of measurement, in spite of some obvious weaknesses, does make a praiseworthy attempt to relate labour used to labour required, without the complication introduced by output differences.

Discovering the Weaknesses Having arrived at a measurement of efficiency of labour use, there is still a further step—to locate the causes of inefficiency. This can partly be dealt with by measurement, but partly it depends on more generalized observation. One of the causes may be poor quality of labour, and this can hardly be measured quantitatively. On the other hand, the technique of work method study which is being used increasingly in agriculture is a fairly successful attempt to apply quantitative tests to the efficiency of performance of specific tasks.

It ought not to be impossible to devise methods of comparing feedingstuffs used with normal consumption requirements for given numbers of livestock and given quantities of output. And as regards stock, such as pigs and poultry, fed mainly on concentrates so that both input and output can be accurately measured, there is no great difficulty. But for those kinds of stock which depend on a wide range of food types, from grazing and bulky crops, such as kale on the one hand to cereals and oil cakes on the other, a completely satisfactory yardstick has not yet been devised. Output per £100 worth of food consumed is a quite common test but is of limited value because it is a composite measurement reflecting both efficiency of production of the home-grown foods and efficiency of conversion.

Nor has anyone yet succeeded in devising any method of relating machinery usage to some sort of standard requirement based on the task to be performed; and in view of the wide range of farm machines and the difficulty of reducing them to any common unit of measurement, the task may be beyond practical possibility.

Conclusion To sum up the position so far as measuring the efficiency of use of resources is concerned, it seems true to say that there is little difficulty in finding out whether the relationship between output and input is satisfactory or unsatisfactory, but that there is still a long way to go before we can judge with any certainty whether an unsatisfactory output-input ratio is due to inefficient management of the resources themselves or to poor technical performance in production.

It is necessary to recognize that the functions of efficiency measurements are limited. They can rarely indicate the specific causes of inefficiency. But this does not mean that they are without practical value. They provide danger signals, directing attention to possible areas of weakness; they do not remove the necessity for inquiry into the practical details of organization and technique on the particular farm; but they assist that process by narrowing the field of inquiry. Such tests can also provide pointers to possible solutions of the problems of the particular farm by presenting the economic results actually attained from existing successful forms of organization and technique. But again, they do not remove the necessity for detailed working out by the trained farm management expert of the probable effects of applying these methods in the conditions prevailing on the individual farm.

Death of Professor R. W. Wheldon

We learn with regret of the death on January 15 of Professor R. W. Wheldon, F.R.S.E., D.Sc., at the age of 60. Well known as a breeder of Jersey cattle, Prof. Wheldon held the chair of Agriculture and Rural Economy at King's College, University of Durham, and was the Minister's Liaison Officer for the Northern Province.

HOME WINTERING OF HILL LAMBS

HENRY EDMUNDS, B.SC.
County Agricultural Officer, Breconshire

The old practice of wintering hill sheep on lowland pastures is becoming costly and difficult. But, as this example from the Brecon hills shows, with careful planning of crops and the introduction of some additional feedingstuffs, home wintering is not only practicable but also far more economical.

SEASONALITY of plant growth poses problems of livestock husbandry the world over. Under favourable farming conditions, where some degree of intensity of production is feasible, cultivated crops tide over the non-growing season. Lack of acres is compensated by high yields of crops per acre. Beyond the horizon of settled farming, where animals depend upon the produce of unfenced and untreated grazings, comes nomadism. The survival formula of both man and animals under nomadic conditions is migration. In Europe today, this probably exists in its original form only with the Lapps of arctic Scandinavia. A fascinating description of the symbiosis between the Lapps and their reindeer is given in Miss Joan Newhouse's book *Reindeer Are Wild Too*.

In between these two extremes of intensive cultivation and no cultivation, are large areas of the world which might be described as marginal in production. Although such areas support settled farmers, nevertheless migration of stock was, and is, a characteristic seasonal feature. The response of sheep farmers in the drier parts of Australia has recently been described in this JOURNAL (1). In Spain, the large-scale movement of sheep from lowlands to hills in the summer has been given the special name of "transhumance". In Wales, many a derelict farm has the name "hafod", meaning a summer dwelling-place: its equivalent in Scotland is known as the "shieling", and in Norway as the "seter". Each of these three local names refers to a system of summering livestock at high elevations and thereby releasing the limited acreage of homestead land for crop cultivation. But with the possible exception of Norway, the custom is now only of historical importance in these three areas.

In Britain the only important form of migration is the "tacking" system with hill sheep, which normally begins in October. This coincides with the sale of draft ewes and other stock, leaving a stock population which is—sometimes optimistically perhaps—regarded as being tightly trimmed to the available food supply of winter. The continuance of this traditional practice is possibly unavoidable on many hill farms even today, but on others which are more amenable to crop production, the position appears to be changing. Much of this is due to the efforts of various scientific workers, particularly in the fields of plant breeding and engineering. Flexibility is now being introduced into a farming world which hitherto has been bound by the chains of unsurmountable circumstances.

Much of the pioneering work in this field was undertaken by Sir George Stapledon and his colleagues (2) on Cahn Hill between 1933 and 1939, and as wintering was even then a problem, it was natural to seek a solution by a programme of land reclamation, based on bred, mineral-efficient strains of grasses and clovers. The results indicated that both ewes and lambs needed a supplementary diet over and above what could be derived even from the improved grazings. This led to the inclusion of other crops, such as dried grass, rape, kale and maize. Although the study of the long-term effects of

home wintering were interrupted by the war, the comparisons that had been made of weight, condition and appearance between sheep kept at home and those sent away revealed but little difference. Useful as these results undoubtedly were, it is usually overlooked that the technique of cultivation which was then developed was of inestimable benefit during the war. The potential value of the crawler tractor, of heavy ploughs and disc harrows was realized; the successful application to other areas of the experience acquired is now a matter of history.

Summer Paradise—Winter Graveyard Few counties can have derived greater benefit from the Cahn Hill work than Breconshire, for, unlike many other hill counties, it possesses soils of considerable productive value at high elevations. Over the years the line of cultivation has been pushed higher and higher. Today, cultivation has reached the eaves, although the roof of common land still remains sacrosanct. The main effect on sheep stocks has been the keeping of larger flocks of breeding ewes. Although in recent years many more lambs have been kept at home, nevertheless the customary migration in the autumn still takes place on quite a substantial scale. As with other farming items, the cost of tacking has also increased, but as long as sheep subsidy payments last, the pill is not unduly bitter.

Scores of thousands of lambs from Breconshire have undoubtedly benefited in the past from the salt air of the Cardiganshire coast during the winter months, but the replacement of the breeding cow by the dairy cow in that county introduced a much more competitive animal for the limited supply of early grass, and made the finding of a suitable wintering ground for sheep much more difficult. Similar changes have occurred in the other wintering counties. A parallel development has been the widespread use of pig netting wire on lowland farms. Stock-proof fences and controlled grazing are excellent things in most ways, but undue interference with the ranging nature of hill lambs is regarded by their owners with a jaundiced eye. Truly, one man's meat is another man's poison. During the last three years when the sheep subsidy was paid (1949–52), the position in Brecon was as follows:

Lambs Wintered at Home and on Tack, 1949-52

Year	At Home		Tack		Total Lambs
	No.	Percentage	No.	Percentage	
1949–50	42,645	68.2	19,904	31.8	65,549
1950–51	40,330	63.4	23,236	36.6	63,566
1951–52	34,374	60.8	22,155	39.2	56,529

Over these three years, the average number wintered away was 21,765, at an estimated cost of between £27,000 and £33,000 per year, but many other sheep, besides lambs, are sent off, and therefore the full expenditure was probably a good deal higher. Now it is doubtful whether, on the high and really exposed sheep farms, this annual charge can be substantially reduced by home wintering, except at the risk of heavy losses. Such risks are taken in many cases, and, although mortality rates are unknown, there is undoubtedly a good deal of truth in the statement recently made at a conference that "the biggest single flock in any hill county is the dead flock". The same thought was expressed this summer by an overseas visitor when he

described the real hill areas of Britain as a "summer paradise but a winter graveyard". Where, however, land at lower elevations and within the farm boundary is capable of cultivation at reasonable cost, there is room for much more optimism.

Wintering at Home on a Brecon Hill Farm It was against this background that the N.A.A.S. held a Farm Walk in the autumn of 1953 on Danycapel, Llanigon, Breconshire, now occupied by Mr. H. E. G. Davies. At an altitude of 1,150 feet, the 108 acres of enclosed land lie on a small plateau at the foot of the Black Mountains. It carries a rearing herd of 38 Herefords, but, as one would expect, the main prop is a flock of 200 Radnor ewes which, with other sheep, brings the summer population to close on 600. Rights of common grazing exist on the adjacent hill. The produce of the 24 acres of tillage—oats, wheat, rape, mangolds and swedes—supply all the needs of the cattle, leaving some for the sheep.

Oats and, particularly, wheat are not normal high elevation crops, but Danycapel is favoured by the kindly Old Red Sandstone soils. Relatively deep soils of an inherently fertile character, when well farmed, go a long way to offset the other natural limitations of high altitude. But this position was not achieved without a comprehensive fertilizer programme. An initial soil analysis indicated a deficiency of 4 tons per acre $Ca\,CO_3$ on the land to be ploughed, while the P_2O_5 situation was equally bad. Between 1948 and 1953, 163 tons of ground limestone, 49 tons of slag and 5 tons of complete fertilizers have been applied. A policy of fertility build-up was the prerequisite to maximum yields. Equal care was given to the selection of good seeds mixtures, which are sown at far heavier rates (35 lb. per acre) than is normally recommended. An active production programme involved the use of substantial capital, and to reduce the burden full advantage was taken of the various grants available. Such doses of "State oxygen" have enabled many to surmount the economic ill-health from which hill farming suffered.

During the five years of Mr. Davies's occupation, hard work and good judgment have together resulted in a substantial increase in the head of stock, both sheep and cattle. For the greater part of this time it has been a one-man effort. Isolation and a good supply of regular labour are, as on most hill farms, incompatible conditions.

When Mr. Davies took possession of this farm in 1948, he followed custom and tradition by sending away his lambs on tack. The problems of high cost and the difficulty of securing suitable land were made even more unpalatable by the fairly heavy losses sustained. But until sufficient fodder was available at home, little could be done. This then was the spur to quick action, and during 1948–50 approximately 25 acres were ploughed and reseeded. Consequently, in the winter of 1950 all lambs (130) were wintered at home for the first time. Unfortunately, between 20 and 30 died, and it was clear that much better conditions were needed. This entailed certain changes in management, and a plan of operations was devised to obviate such losses. The starting point for future years would be at tupping time. Experience indicated that little grass could be expected before mid-April, and consequently rams were turned to the ewes at such a time in October that no lambs would be born before April 12. Prior to this, ewes were flushed for milk on mangolds for a few weeks. In the spring of 1952, and in the following year, lambs were strong at birth and ewes possessed sufficient milk. But lambing difficulties were not absent. Many of the troubles could have been avoided by earlier lambing, but there would then have been little grass and therefore

little milk. On balance, rather late lambing appeared to be sound, although this involved inspection three times a day for a few weeks. Night inspection is too disturbing to the flock as a whole.

Introduction of Concentrates With the winter always in mind, it was thought that 8–10 acres of mangolds and turnips, a similar acreage of rape and a few acres of oats, might provide a better diet than was the case in 1950–51. But cattle stocks were also increasing and, productive as the farm was now becoming, self-sufficiency appeared to be only wishful thinking. If lambs were to grow and thrive, then the alternative was to supplement home production by purchased concentrates. For a hill sheep farmer, this was indeed a radical departure from local practice. Not to do so, however, would be to spoil the ship for a ha'porth of tar.

It must be recalled that at this time feedingstuffs were on ration and consequently the choice was restricted. Nevertheless, molassed sugar beet pulp and field peas were bought at a cost of £66 9s. 7d. Feeding started in late October 1951 with 170 ewe and wether lambs. The weather was fairly good until January, when 35 wethers were graded. The remainder came through the winter very well and, unlike the previous year, losses were few—less than five. The remaining wethers were sold in the following autumn. The experiment looked promising.

Now until the winter of 1951–52, wether lambs were kept until they were three or four years old. Did the change, as an outcome of an improved diet, mean that some might even be sold within a year of birth, and in any case not later than eighteen months?

By the winter of 1952–53, Mr. Davies had 200 lambs, which meant a greater outlay on purchased feedingstuffs, amounting to £126 10s. 6d. It included $6\frac{3}{4}$ cwt. flaked maize, 41 cwt. oats and 83 cwt. baled hay. The weather was not so kind in the early winter months as in the previous year. and so no lambs were graded. Nevertheless, losses were again pleasingly low (3–5), while growth and general appearance were satisfactory. When turned out to the hill for summering, no more difficulty was experienced in keeping them up on the rough grazings than had been the case with tack lambs in earlier years. The wethers returned in late September to aftermath, and were eventually finished off on rape. One bunch of forty averaged 58 lb. estimated dead weight, the others slightly less.

Early Feeding Encouraged During the winter of 1952–53 the lambs were confined to 25 acres of leys from late October until early March. Troughs were filled with pulped roots, with which was mixed either flaked maize or whole oats. Hay was available from racks. Mixing was done on the day previous to feeding, and next morning was taken to the troughs by tractor. The pulp, apart from its nutritional value, enabled a better distribution of concentrates to be made for all lambs. Mr. Davies firmly believes in early feeding to avoid losing the condition that is acquired over the summer. To encourage the lambs to eat, a few old ewes who were familiar with the taste of concentrates and roots were run with the younger sheep. Gentle but constant shepherding for a week or so was equally desirable to keep all backward lambs well up to the troughs. Some weeks elapsed before the full ration was eaten by all the lambs, but from the first week in December until the end of February it is calculated that each lamb ate $\frac{1}{3}$–$\frac{1}{2}$ lb. per day of concentrates, apart from hay and roots. The ration was then tapered off and, by the second week of March, hand feeding had ended. As a small but interesting practical detail, Mr. Davies noticed that

his lambs were much more inclined to start eating on a cold, dry day than on a wet one.

Regularity of feeding time, day by day, was found to be essential. The lambs, once they had become accustomed to their food, gathered round the troughs at the usual time and remained there until they were fed. Any delay retarded their grazing habits, as well as limiting their exercise. Troughs were sited fairly close together so that any of the smaller lambs which were crowded out could quickly find another place less congested. Given regularity of feeding, the forage instinct soon returned after the meal was over.

Such, then, is the system of one hill farmer working single handed. Before it succeeded, there were many facets to be cut and polished. These included a well-planned crop and grass programme, a careful selection of sheep to suit the environment, and a high degree of managerial ability.

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HARDINESS IN HILL SHEEP

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Hardiness as a heritable character focuses attention on the ram. Investigations at Bangor give some interesting information on a matter of paramount importance to hill farmers.

UNTIL very recently the breeding of hill sheep was a subject which had not received a great deal of attention from scientists; it was regarded as the province of farmers and shepherds alone. The degree of improvement that can be made in the systems of management and nutrition is limited, and there are great difficulties in the application of the scientific methods used so effectively with cattle or sheep kept under intensive agricultural systems and on comparatively high levels of nutrition. But scientists and hill farmers alike are now beginning to realize that the advice and techniques successfully applied in other fields may be modified to assist hill flockmasters.

Breeding for Hardiness One controversy amongst hill farmers concerns the use of rams of a hill breed which are neither bred nor selected under the rigorous conditions of the hill. In Wales, for example, this concerns the relative merits of hill-bred hardy rams, as against pedigree rams from flocks maintained and selected for many generations under lowland conditions. The pedigree or lowland Welsh sheep is characterized in its own environment by larger size, earlier maturity and a softer fleece type, but the view is widely held that these sheep, although economically better types in comparison with the more primitive mountain sheep, have become "soft" by virtue of the selection practised under the more favourable conditions. It is believed that if rams from these flocks are used on hill ewes they will rob the lambs of that heritage of hardiness which enables them to survive and thrive under the hard conditions of climate and

nutrition found on the hill. Recently published results of experiments on laboratory animals(1) to some extent bear out the validity of this belief. It is probably true that "improvement" or directed change may be brought about more rapidly when the animals are kept in an environment which allows them full expression of their genetic potentialities in a particular character. However, it is possible that various economic characters, under poor conditions, depend on an entirely different genetic make-up from that which controls their expression in the best environment. Just as poor conditions of feeding and climate may mask an individual's genetic potentiality for production under better conditions, so may the better conditions mask the individual's inability to thrive under the poorer conditions. Or again, in terms of Welsh hill sheep, selection in the lowland pedigree flock may be detrimental to that elusive, but very necessary, quality of hardiness.

Another difficult question following this is the actual selection of breeding stock. The normal system of allowing a number of rams to run with the whole flock of ewes does not allow of any great genetic improvement unless the rams are uniformly good. The two methods open to most farmers are selection of either the rams or the breeding ewes. A high degree of selection is possible in the rams, but its value is reduced by the fact that the choice is usually made on appearance and current fashion, and that any improvement achieved by the use of outstanding sires is of very short duration. Very little effective selection of the ewes is possible, but at least there is a relative permanence of influence, since the ewe flock is closed. Feeding and management have a greater effect on some characters than on others, and when this is the case, selection on appearance does not result in real improvement. Thus it is important that characters for which we select must be fairly highly heritable.

Breeding Experiments at Bangor College Farm Work on progeny testing of hill rams has been carried out at Bangor for some years now, and a report appeared in this JOURNAL in 1948 (2). Since 1951 the experiment has been extended to cover other aspects of the breeding and improvement of Welsh hill sheep. Rams of both "pedigree" and "hardy" type have been mated to groups of about fifty ewes in separate enclosures, and the lambs from these have been recorded from birth onwards. For our purposes, the main criteria of individual adaptation to the hill life are body weight and liveweight increase in conjunction with lifetime production, fertility, birth coat and adult fleece type, and weight. The birth coats are classified into categories 1, 2a, 2, 2c, and 3, according to the method of R. G. White and Fraser Roberts, as described by G. Ll. Williams (*ibid*). Grade 1 coats are covered all over with long, hairy fibres. They are generally regarded as the best protection against bad weather and seem to result in a good adult fleece. At the other extreme, Grade 3 has short, fine, curly fibres almost wholly covering the body, and is believed to give very poor protection. The adult fleece is classified on several scores, including length of fibres, fineness of wool, density of fleece and amount of kemp. Since the primary function of fleece in a hill sheep is one of protection, attempts are being made to determine the fleece characters which provide the best weather coat.

It will eventually be possible to separate the whole flock into groups according to the proportions of pedigree blood possessed, and thus make effective comparisons of the effect of pedigree and hardy rams. Table 1 shows, as an example, the distribution of birth coats found in forty lambs, born in 1953 and grouped according to blood.

Table 1

Analysis of Birth Coats of 40 Lambs

Fraction of Pedigree Blood	Birth Coat Grades				
	1	*2a*	*2*	*2c*	*3*
$\frac{7}{8}$	5	1	2	3	5
$\frac{15}{16}$	1	0	1	2	1
$\frac{31}{32}$	7	2	2	0	0
$\frac{1}{8}$	8	0	0	0	0

In the whole flock, even when the dam's sire is not known and the pedigree fraction of the lamb cannot be found, the pedigree rams are seen to throw many more poor birth coats than do the hardy rams.

Table 2

Birth Coats of All Lambs Born in 1953

Sires	Total Number of Lambs	Birth Coats (percentage)					
		1	*2a*	*2*	*2c*	*3*	*Total*
Four pedigree rams	192	43	21	21	8	7	100
Three hardy rams	136	68	15	16	1	0	100

The weights of the lambs at birth, ear-marking and shearing as yet show no appreciable differences as between the rams of either kind, although the lambs with little pedigree blood in the forty shown in Table 1 were, on average, about 3 lb. heavier at shearing time. When weighed in September 1953, at about six months old, the lambs from the hardy rams averaged about 3 lb. heavier than the others. The complete comparison will not be available, however, until these lambs themselves produce three lamb crops.

Even without complete information, it does seem that fleece type differs according to whether pedigree or hill blood predominates. However, wide differences in opinion exist as to the best type of fleece for a hill sheep, and the hill rams themselves vary considerably in this character.

Selection of Ewe Lambs Results on the selection of individual *rams* by means of progeny testing will be published separately. The proportion of ewe lambs which can be culled in the Welsh Mountain sheep is very small, as only three crops of lambs are taken before the ewes are drafted. In other hill breeds, where four crops are taken, the number of replacements is considerably smaller, and a greater selection is possible. Since many of the lambs are culled on a basis of type, an extremely small effective selection is left. If, then, any improvement is to be made through the ewes, the methods of choosing the lambs must be carefully studied. Selection is normally carried out at the end of September before the lambs go away for wintering, when the average age is about six months. Due to the high cost and difficulty of finding suitable wintering, it is essential that the number of lambs sent away be kept to a minimum. Analysis of data obtained at Bangor suggests that, contrary to views expressed by G. Dunlop(3), the weight of ewe lambs at this time is a fairly good basis for selection. The correlation between date of birth and weight at six months in the unselected flock indicates that selection for size at this time is not simply a selection of the oldest lambs. High correlations are found between this weight and those of the adult sheep, showing that the six months' weight is a fairly good guide to future weight. Since the price of draft ewes depends

largely on size and condition, this is a valuable consideration. From data obtained from the fully – recorded College flock, we are justified in asserting that under normal circumstances the weight of a ewe lamb at six months is a fairly good guide to the weights of its subsequent lambs.

It can also be shown that certain fleece characters, notably length and lack of lockiness, are positively correlated with adult body weight, indicating that fleece of this type makes for a better adaptation to hill environment than does a very short, locky fleece type. If these qualities can be shown to be highly heritable, and can be judged at an early age, they are a further basis for effective selection on appearance.

About thirty hill ewes chosen at random have been kept down on the lowland to run with the College pedigree flock. These will be tupped with hardy rams to compare production under adequate nutritional conditions. Comparisons between sheep from hill and lowland can thus be made under both hill and lowland environments.

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National Diploma in Agricultural Engineering
" Farm Mechanization " Scholarship

The "Farm Mechanization" Scholarship will again be available for award in October 1954. The Scholarship, which is valued at £100, will be applied for the benefit of a student eligible to undertake the course of study leading to the Final Examination for the National Diploma in Agricultural Engineering, and will be tenable for a year at one of the Agricultural Colleges approved by the Examination Board of the Institution.

Full particulars, together with forms of application, may be obtained from the Secretary, The Institution of British Agricultural Engineers, 24 Portland Place, London, W.1. Closing date for receiving completed applications is May 14, 1954.

SOCIETY OF CHEMICAL INDUSTRY
Agriculture Group
FORTHCOMING MEETINGS

1954		
March 15	Some Recent Developments in the Field of Plant Growth Substances	PROFESSOR R. L. WAIN
March 16	Recent Advances in Fertilizer Placement	DR. G. W. COOKE and DR. J. W. S. REITH
April 12	Annual General Meeting of Crop Protection Panel and Chairman's Address	
April 20	Large-scale Clearing of Forests (Afternoon and Evening Symposium)	

Full particulars from the Gen. Sec., 56 Victoria Street, London, S.W.1.

THE MANURING OF FRUIT

2. MATURE TREES

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The following article deals with the manuring of established plantations, and gives some guidance on the recognition and method of correcting acute mineral deficiencies.

FERTILIZER treatment varies as between dessert and culinary apples, but with both, once available potash reserves in the soil have been built up to a satisfactory level, it is unnecessary and undesirable to give further heavy dressings of potassic fertilizers, which may induce magnesium deficiency. A yearly application of 1 cwt. muriate of potash per acre (or 2 cwt. every second year) should be adequate for maintenance. So far as phosphates are concerned, 3 cwt. superphosphate per acre every third year should be adequate, although rather heavier dressings may be required in grass orchards to retain the clover content of the sward. Basic slag is sometimes used in grass orchards for this purpose. A dressing of 1 cwt. magnesium sulphate per acre per year should also be sufficient to prevent magnesium deficiency from becoming a serious problem. The steps which should be taken when severe magnesium deficiency is already established are described later in this article.

The amount of nitrogen which it is necessary to apply to dessert apples (and to fruit crops in general) depends very much on soil and rainfall. Where soils suffer from some defect, such as insufficient depth or impeded drainage, or where the summer rainfall is low, then substantially heavier dressings of nitrogen have to be given. Where growth is satisfactory, 3–4 cwt. sulphate of ammonia per acre per year should be adequate for the average case. On poorer soils or under dry conditions much heavier dressings may be necessary, even for varieties such as Worcester Pearmain. As already mentioned in Part 1, heavier dressings are usually required under grass conditions and also after trees have been removed in the course of orchard thinning operations, or where root damage is suspected following a wet winter.

Some growers give nitrogen in midsummer with the idea of encouraging next year's fruit buds, but at present there is little convincing evidence of the value of this treatment. Urea sprays have also been used by a number of fruit growers, and these may prove a useful first-aid measure when the root systems of trees have been damaged following a wet winter. Farmyard manure, although not generally recommended for dessert apples, may be used with advantage when growth is poor.

Similar dressings of phosphatic and potassic fertilizers should be given to culinary apples as to dessert apples, although it is generally true to say that culinary apples on strong stocks are more efficient in obtaining available nutrients from the soil than are dessert apples on weaker stocks. Heavier dressings of nitrogen are required for culinary apples; say, up to 10 cwt. of sulphate of ammonia per acre for Bramley's Seedling and rather smaller amounts for varieties such as Newton Wonder. Good quality farmyard manure, if available, can often be used with advantage on culinary apples.

It is not usually necessary to give dressings of magnesian limestone or magnesium sulphate to culinary apples, as most varieties appear to be

resistant to magnesium deficiency, except on very light soils and in abnormal seasons. However, there are some exceptions: Edward VII and Grenadier, for example, are fairly susceptible to magnesium deficiency.

Pears, Plums and Cherries Most varieties of pears and plums show a higher need for nitrogen and a lower requirement for potash than do dessert apples (but see the notes below on potash deficiency). Traditionally, these crops are grown under conditions of clean cultivation and given dressings of organic nitrogenous manures, such as farmyard manure, shoddy, meat-and-bone, etc. It is recommended that phosphates be given as for apples, but dressings of potassic fertilizers should be slightly smaller. They should receive ½–2 tons of shoddy (depending on the grade) or 10 cwt. meat-and-bone, etc., in addition to 2–3 cwt. sulphate of ammonia per acre. Pears and plums may be grown successfully under well-managed grass conditions, provided the soil is not too dry, and they should then receive annual dressings of sulphate of ammonia at the rate of 4–10 cwt. per acre.

Both pears and plums show considerable resistance to magnesium deficiency, except when the soil is abnormally deficient in available magnesium.

Cherries are similar to pears and plums in that they have a relatively high requirement for nitrogen, and in many of the better Kentish orchards 15 cwt. or more of meat-and-bone per acre per year are often given. Only moderate amounts of phosphates and potash are required so far as the trees are concerned, and, like pears and plums, cherries are resistant to magnesium deficiency, except in the first few seasons after planting. If desired, 5–10 cwt. sulphate of ammonia per acre may be substituted for nitrogen in the organic form.

Acute Mineral Deficiencies The following notes deal mainly with the *causes* of acute mineral deficiencies in tree fruits and the methods of treating them. Symptoms of mineral deficiences and the effects on fruit quality are not given in detail, as such descriptions can be misleading unless gone into very fully. Any grower in doubt should consult his local N.A.A.S. advisory officer.

NITROGEN

Trees suffering from a lack of nitrogen have pale leaves which drop prematurely. Such trees may blossom profusely but fail to set a satisfactory crop. When nitrogen is acutely deficient, even blossoming may be reduced. The fruit of low nitrogen trees is often, although not invariably, of a high quality, and the control of nitrogen level is an important factor in dessert apple production. As already mentioned, the quantity of nitrogenous fertilizer required depends to a large extent on soil and rainfall, and on the standard of sward management in the case of grass orchards. Excess of nitrogen (especially under low potash conditions) leading to excessively vigorous growth may be a predisposing cause of canker.

POTASH

Dessert apples and, perhaps, apples in general, have a higher requirement for potash than the other tree fruits, although there are some exceptions to this. Purple Pershore plums, for example, show a marked yellow chlorosis if potash is deficient. There are considerable stock and variety differences so far as susceptibility to potash deficiency is concerned (as is the case with all mineral deficiencies) and the symptoms themselves vary with different varieties. The symptoms exhibited by Purple Pershore are rather abnormal, and in most fruits they take the form of a marginal, ashy leaf scorch preceded

by a marginal and interveinal chlorosis. In some varieties, for example, Laxton's Superb, the edge scorch may be red-brown in colour. Branches die back when the condition is acute.

Potash deficiency is accentuated by poor drainage, and is often observed first in areas of colluvial (downwash) soils, presumably due to the fact that such soils have been leached of nutrients during their formation. Once this particular deficiency is established, it may take three or four years of generous manuring with potassic fertilizers to correct the condition, due to the slow penetration of potash into the root zone of the trees. Grassing down can be most helpful, perhaps because it induces the trees to surface root where potash supplies are usually better, and also because of the return of available potash to the soil in the form of grass mowings. Excess of potash is to be avoided, as being a predisposing cause of magnesium deficiency.

MAGNESIUM

Here again, most dessert apples and some culinary apples show a marked susceptibility to magnesium deficiency. Trees (including cherries) often show symptoms in the first season or two after planting, presumably due to lack of roots, but these symptoms usually disappear when the trees get established. The symptoms of magnesium deficiency are many and varied, depending on variety, nitrogenous manuring, rootstock and soil, but, in general, they can be divided into the type exhibited by Miller's Seedling and Edward VII (a brown edge scorch tending to be interveinal), and the better known interveinal pattern, sometimes preceded by purpling, exhibited by Cox's Orange Pippin and Sunset. Considerable care is necessary in some cases to distinguish magnesium deficiency from potash deficiency or some other condition. Defoliation in the older leaves of the terminal shoots in late summer is usually seen in cases of magnesium deficiency.

Routine prophylactic measures to be taken against magnesium deficiency have already been described. When the condition is severe and accompanied by die-back, it may take at least as long to cure as acute potash deficiency. Annual dressings of 3–4 cwt. magnesium sulphate per acre should be given for several seasons, plus four or five post-blossom sprays per year of 2 per cent magnesium sulphate solution (20 lb. of magnesium sulphate per 100 gallons of water plus "spreader"). Magnesium sulphate may be added to many, but not all, of the spray materials used by fruit growers, and the advice of the manufacturers of such sprays should be sought in doubtful cases.

Potash and magnesium deficiency can occur together, but serious cases of magnesium deficiency are usually found where excessive dressings of potash have been given. Under such circumstances, reduction or omission of potash fertilizers may be required for several seasons.

IRON

Iron deficiency is the commonest micro-nutrient disorder of tree fruits in south-east England. It occurs on chalky land, soils over Ragstone, and in plantations which have been over-limed. Pears on quince stocks are probably most susceptible to iron deficiency, followed by plums, apples and cherries in order of decreasing susceptibility, but here again there are marked variety and stock differences. Among apple varieties, for example, Edward VII and Norfolk Royal may show some resistance to iron deficiency, but such differences are not always reliable. Root trouble (for example, due to wind rocking or poor drainage) is often an aggravating cause of iron deficiency.

Iron deficiency is characterized by a chlorosis, beginning at the tips of the shoots, in which the veins stand out as a green network. It is accompanied

in severe cases by some leaf necrosis and shoot die-back. Symptoms are frequently severe on leaves below pruning cuts. Grassing down is often partially successful in curing this condition, but in severe cases it is necessary to resort to injections of iron sulphate pills into the trunks of the trees. Such injections can be very successful in relatively young trees and the effects may last for three or four years, but they can fail in older trees in which there is much dead wood. Injections should be carried out before bud-burst, and the holes should be securely plugged with corks to prevent the dissolved salt running back and damaging the cambium. Plums and cherries (especially the former) often gum badly after injection, but this is not known to be harmful. New organic iron compounds, which are at present the subject of experiment, show some promise, and it may be that eventually there will be alternative ways of controlling iron deficiency.

Potash deficiency and impeded drainage appear to accentuate iron deficiency.

Manganese

Manganese deficiency is not uncommon in tree fruits, but it is perhaps most severe in cherries. This trouble occurs on soils which are well supplied with lime, often where there is some hindrance to drainage, but it is also commonly found in cherries on well-drained mineral soils in north Kent.

Injections of manganese sulphate may be used to correct this condition, but the more satisfactory course is to spray the trees when they are in full leaf with a solution of manganese sulphate (3–5 lb. per 100 gallons of water plus "spreader").

Copper and Zinc

Occasional cases of copper and zinc deficiencies are found in the south-east in apples and pears, mainly on light soils. In one case investigated by J. O. Jones and the writer, in which copper deficiency was causing a severe die-back in pears, the best treatment was found to be to spray the trees in May with a very dilute copper sulphate solution ($\frac{1}{2}$–$\frac{3}{4}$ lb. of copper sulphate per 100 gallons of water plus "spreader"). Zinc deficiency is characterized by rosettes of very small leaves and subsequent die-back. Here again, a good response is obtained by spraying the trees in leaf with a very dilute solution of zinc sulphate.

Next month: Soft Fruit

LAND FROM THE SEA

A SEQUEL TO THE NETHERLANDS FLOODS

P. G. MEUWISSEN

Technical Assistant to the Agricultural Attaché to the Netherlands Embassy

The plight of the Dutch after the grievous flood disaster of February 1953 was pitiful. But after a characteristic and magnificent effort, the Dutch people have succeeded in less than a year in repairing their badly damaged sea defences and reclaiming over a third of a million acres of flooded land.

AT a few minutes before midnight on November 6, 1953, Queen Juliana of the Netherlands watched the final caisson being sunk successfully in the last gap at Ouwerkerk on the islands of Schouwen and Duiveland. This marked the end of the first phase of the tremendous efforts to wrest from the sea the vast area of the Netherlands which was inundated by the disastrous flood of February 1, 1953. A first effort to close the breach failed, and there is little doubt about the anxiety with which this final operation was followed, not only by the Royal visitors, but by many who had come from near and far to witness the closing stage of a valiant struggle. There was great rejoicing at the success of the operation, and rightly so, for the Dutch had once more conquered their eternal foe. In this latest, and perhaps the greatest, conquest, much is owed to the help which came from all parts of the world. The caissons, weighing 7,000 tons each, of which four had to be used to fill the gap at Ouwerkerk, were built in England and are claimed to be the largest ever made. The first was put in its place by six tugs on October 30, the second followed on November 4, and the third the day after. The whole undertaking had to be finished before the autumn storms were at their height, otherwise the islands might have been lost for ever after another winter of lashing sea waves. The islands are not yet dry, but pumping has begun to drain the water away.

During the first reconnoitre soon after the flooding, it was found that dykes over a length of 300 miles were damaged. There were 67 large breaches below the high-water mark, through which the sea could flow freely at every turn of the tide, scouring ever deeper channels and covering the land with sand and black mud. Besides these, there were 495 smaller breaches above the high-water level. The largest breach, near the Schelphoek, was over 13,000 feet wide and some 100 feet deep, through which 4,600 million cubic feet of sea water could flow during every tide (a matter of six hours)—a rate comparable with that over Niagara Falls.

Work at the shallow holes in the inner dykes was started almost immediately in February, and by the end of that month considerable areas had been drained. The huge gaps in the sea defences were a different proposition, and serious work could not begin until May. By the end of July, however, all but four breaches had been closed. Of the whole flooded area of 352,500 acres, only 40,000 acres remained under water at that date. It is expected that by next spring all areas will be completely dry, barring unforeseen circumstances.

An impression of the herculean job it has been can be gained from the fact that working at the last four breaches were 67 large sand-dredges, 283 draglines, 133 tugboats, 266 tractors and steam shovels, 56 cranes and bulldozers, 115 locomotives, and a number of "DUKWS" and war-time landing craft!

The introduction of the caisson has greatly improved methods of dyke repair. Previously the Dutch have always relied on willow mattresses which, after being sunk in the hole, are piled with stones. The use of concrete caissons, which were thoroughly tested in the creation of Port Mulberry along the coast of Normandy, may well have saved the islands of Schouwen and Duiveland from extinction.

Fighting the Salt Immediately the land became dry, soil samples were taken and tested for salt content to enable the authorities to give correct advice on subsequent treatment. The sea had penetrated far inland under the influence of the storm, and therefore the damage done to the land by salt was severe. Tested samples showed that the variation in salinity was considerable, but generally speaking the salt content of the soil decreased from west to east.

Comparable data have been collected which illustrate the decrease in the salt content of land which became dry in the spring. To obtain reliable information, the test samples used represented all the different types of soil which had been subject to flooding. Tests were taken at depths of between 0 and 5 cm. and again between 5 and 20 cm. The reason for specifically sampling the top 5 cm. is that this upper layer is, owing to changes in weather conditions, very subject to variation, especially on light soils. On July 28, compared with the spring, the reduction of the salt content in the 5–20 cm. layer was generally negligible. The salt content of the upper layer was generally considerably higher than that in the lower strata. But on October 8, it was found that practically everywhere a considerable reduction had occurred in the lower layer. The following figures show the fall in salt content from spring to October for the different groups of salinity in the lower layer:

1–3	grm.	per	litre	soil	moisture	reduced	by	between	0.9	and	1.4	grm.	
3–6	,,	,,	,,	,,	,,	,,	,,	,,	1.0	,,	4.2	,,	
6–10	,,	,,	,,	,,	,,	,,	,,	,,	2.5	,,	7.7	,,	
10–15	,,	,,	,,	,,	,,	,,	,,	,,	3.4	,,	8.6	,,	
Over 15	,,	,,	,,	,,	,,	,,	,,	,,	7.0	,,	17.8	,,	

When the averages in the different groups are calculated the position is :

Salt Content in Spring *grm.*				Salt Content in October *grm.*
2.4	..	..	..	1.2
4.2	..	..	..	3.0
7.9	..	..	..	3.8
13.0	..	..	..	5.0
18.2	..	..	..	5.2

It was further found in October that in 87 per cent of the tests of the upper layer of 0–5 cm. depth the salt content was *less* than at the 5–15 cm. depth, while in the remaining 13 per cent, where the salt content was higher in the upper layer, the difference between the two layers was usually only a few tenths of a gramme. It may therefore be generally accepted that by October between one-half and two-thirds of the salt had disappeared from land which became dry in the spring.

The final estimate of the total area of flooded land was 352,500 acres, and of this 200,000 acres were still flooded on March 1. On April 1, the area had been reduced to 56,000 acres, of which 47,500 acres were in the Province of Zeeland. The damage was greater according to the length of time the land had been under water and the proximity to large gaps in the defences. For

Netherlands Embassy

Breach in the dyke near Dinteloord, North-Brabant.

Repair work in progress on the islands of Schouwen and Duiveland.

Head of the eastern half of the ring dyke round the third breach at Kruiningen, Zeeland.

Photos: *Netherlands Embassy*

Work on breach near Kruiningen, May 1953.

The final caisson is placed in position.

Photos: *Netherlands Embassy*

MYXOMATOSIS OF RABBITS (See pp. 503-8)

The symptoms of the disease are characterized by an intense swelling and inflammation of the eyelids, which spreads towards the forehead and ears and may also affect the genital region.

miles inland, deep gullies (sometimes of 60 feet) had been made near serious breaches. But, in an area of about 125,000 acres, damage of this kind is almost negligible. Ditches and other watercourses, except in the immediate area of a breach, were hardly damaged, since inundation lasted only a short time. It is very difficult to estimate the cost of restoration of flooded land; we think it will vary from as little as £1 to as much as £480 an acre.

Where the structure of the soil had suffered, gypsum was used on arable land, but not on grassland. It is estimated that 60 per cent of the flooded land required gypsum application, the quantities needed per acre varying with the salinity of the soil. During 1953 plans were made to use a total of 260,000 tons of gypsum. It was supplied to farmers free. A further 240,000 tons will be made available later. The amount of gypsum applied was relatively greater than that used during the restoration of Walcheren, which was flooded towards the end of the war. The purity of the gypsum was also of a higher grade—95 per cent. compared with an average of 75 per cent in that used on Walcheren. It is hoped that these improvements will reduce the time required to restore the land.

Cultivation and Arable Cropping Wherever possible the land has been lightly cultivated, in accordance with the advice of the Advisory Service, and sown with crops. The expenditure on cultivation, seeds and sowing, harvesting, etc. was refunded by the Government. The proceeds for crops obtained were, however, deducted from the costs incurred in putting the land in order, and, where the proceeds covered production cost, no payments were made by the Government. A cost price calculation of all crops or groups of crops and grassland was made to serve as a basis for these refunds, but farmers were only paid if the advice on cultivation and cropping referred to above was acted upon. A special commission was appointed to estimate the proceeds of crops grown on each field or in each area, as the particular case required.

It is difficult to estimate average yields of crops grown in the inundated area. Owing to the exceptionally dry weather in March, barley proved very difficult to grow. The yield of barley east of the line Rotterdam—Willemstad—Steenbergen—Bergen-op-Zoom exceeded 23.6 cwt. per acre, but in general yields diminished to nil westwards of this line to the coast. Some preliminary average yield figures have been published for the flooded areas, in comparison with the remainder of the country. For the main crops they are:

	Flooded Area	Remainder of the Netherlands
	cwt. per acre	*cwt. per acre*
Wheat	22.8	30.0
Barley	12.7	26.58
Oats	20.0	24.16
Potatoes	116.1	194.87
Onions	24.26	30.5

Comparisons have been made between the total national production of 1953 and the mean national production during 1946–52. It appears that in 1953 wheat production was only 79 per cent of average, but barley and oat production increased to 141 per cent and 117 per cent, respectively. The production of potatoes diminished to 86 per cent but the yield of dry bulb onions increased to 149 per cent, mainly as a result of expanded cropping outside the flooded area. There has, of course, been some extension in the acreage of certain crops outside the flooded districts in anticipation of possibly reduced production in the inundated parts.

The development of grassland has been very varied. In several areas there has been no grass at all. The dry weather in March made early-sown grass a failure, and the land there is now covered with weeds. Their destruction will give a lot of trouble in the spring. Restocking the farms with livestock at this stage, therefore, is considered inadvisable in many areas.

According to an official estimate based on information so far available, it is assumed that by 1956 an area of 210,000 acres will produce normal yields, 123,500 acres yields of between 75 and 100 per cent, and 12,350 acres yields of between 50 and 75 per cent of normal, always provided the weather plays its part.

Totalling the Cost As a result of the flooding, more than 90,000 people were evacuated, but by August 1953, 60,000 had returned. The rest are mainly those who lived on the islands of Schouwen and Duiveland. Roads in areas which were dry by August had suffered less than was expected, and, except at Kruiningen, they have been restored. Of the houses and farmhouses, 25,000 were slightly damaged, 5,000 suffered heavy damage, and 4,000 were totally destroyed.

On the basis of the rehabilitation costs, the damage is estimated by the Netherlands Government at approximately £85 million. This amount only partly takes into account the decreased production as a result of the floods, and takes no account at all of the damage to furniture, clothing, etc., which can probably be replaced from the National Disaster Fund. This Fund, which includes gifts from abroad, amounts to about £12 million. The £85 million will be drawn from the Netherlands Treasury. It has, however, been agreed with the United States Government that for the rehabilitation of dykes, farmland, roads, etc., a sum of £40 million may be used out of the balance of the counterpart fund of the American economic aid received in recent years in the form of grants in aid.

Agricultural Scholarships

The Ministry of Agriculture and Fisheries is again offering a limited number of senior and junior scholarships to the sons and daughters of agricultural workmen, smallholders and other rural workers. The scholarships are for courses in an agricultural or allied subject, including veterinary science, at University Departments of Agriculture, Agricultural Colleges, and Farm Institutes. Candidates must have attained the age of 17 by September 30, 1954.

Full details and application forms may be obtained from the Secretary, Ministry of Agriculture and Fisheries, (Room 313), 1 Cambridge Terrace, Regent's Park, London, N.W.1, or from Education Offices of County Councils. The closing date for the receipt of completed applications is March 31, 1954.

THE NATURE CONSERVANCY

NIGEL HARVEY, M.A., Q.A.L.A.S.

With the establishment in March 1949 of the Nature Conservancy, a new term—" nature reserve "—was added to the language of the countryside, and a new idea—the conservation and management of British flora and fauna in the natural state—was born.

THE hand of man lies heavy on the British Isles, where for many centuries a singularly vigorous and inventive race have devoted a considerable part of their energies to adapting the primeval countryside to human purposes. Indeed, the modern English landscape is one of the most remarkable achievements of mankind, for few other areas in the world have been so developed or so "humanized". But all this has been achieved at a price, for wild nature is scarce in these crowded and industrialized islands. It is, for instance, three centuries since our forefathers launched their first sustained attack on the fenlands, and the very difficulties they overcame showed that even in their time the ancient Waste had surrendered many of its resources to the exploitation of man. Today, the Waste is no more than a memory, and with it has gone much of our wild life heritage. There were bears in Saxon England, wolves in Medieval England, wild boars in Tudor England, and the extermination of these animals is merely one obvious instance of the destruction which man has brought to the " Kingdom of the Wild " in this country. It is, after all, no more than two lifetimes ago that an otter was hunted in the Serpentine and a woodcock was shot where Oxford Street now stands. Further, the very scarcity of wild life has added to their dangers, for the collector of rarities may well complete the work of the reclaimer and the builder. Half a century ago you could pick fritillaries in the meadows around Oxford; today, if you want to see fritillaries you go to the gardens of Magdalen College and admire them on the other side of a fence. And the fence is significant. Man the destroyer has turned conservator, for the Kingdom of the Wild is no longer strong enough to protect itself.

Such is the general background to the Nature Conservancy, one of the latest additions to the various public bodies which have taken their place in the rural economy. The work of this new body was outlined recently in a paper read to the Royal Institute of Chartered Surveyors by Captain Cyril Diver, C.B., C.B.E., the Director-General of the Conservancy, and from that address much of the matter in this article has been drawn. The Conservancy was established by Royal Charter in March 1949 as a corporate body directly responsible to the Committee of the Privy Council for Agricultural Research, the Lord President of the Council becoming, therefore, the Minister responsible for the Conservancy in Parliament. The terms of incorporation define its unusual and interesting functions as :

1. The provision of scientific advice on the conservation and control of the natural flora and fauna of Great Britain.
2. The establishment, maintenance and management of nature reserves in Great Britain, including the maintenance of physical features of scientific interest.
3. The organization and development of appropriate research and scientific services.

What is a Nature Reserve ? The term " nature reserve", however, deserves some examination, for it is not infrequently confused with " national parks". In over-simple terms, these nature reserves are relatively small areas—sometimes very small—selected because of their peculiar scientific interest ; they include, for instance, the site where the Piltdown skull was discovered. They are, therefore, areas of study rather

than public parks, though reasonable access for the public will, no doubt, be allowed in suitable cases. National parks, on the other hand, are essentially large areas, selected primarily for scenic beauty or for amenity, where control of development, in the planning sense of this word, is stricter than is considered necessary elsewhere.

Nature reserves and national parks are, therefore, very different entities, and it was convenient rather than appropriate that certain provisions concerning the former were included in Part III of the National Parks and Access to the Countryside Act of 1949. Section 19, for instance, requires that areas managed as nature reserves shall be "declared" to be such by the Conservancy before that body can make bye-laws affecting them. Section 21 gives to local planning authorities the same statutory powers and duties as those conveyed to the Conservancy for the establishment of local nature reserves. Section 23 lays on the Conservancy the obligation to notify the local planning authority of areas of special interest, so that the authority will have the scientific case before it when it decides on the development of such areas. Such a notification, however, in no way infringes the rights of the owner of the land. It does not prevent him from doing on that land any of the things that the law, as it stands, allows him to do. It merely informs the local planning authority of one set of matters which should be taken into account when considering a development proposal. Section 25 gives land managed by the Conservancy the status of Crown Land, so that it cannot be compulsorily taken over by another body. If the Conservancy are in conflict with another Government Department, the matter is, therefore, resolved internally, if necessary going up to the Ministers concerned for decision.

The Conservancy, though not a Government Department except in respect of land-holding, is a Government organization, and its staff, many of whom are qualified scientists, are paid from an annual exchequer grant. But it can and does receive gifts, trusts and, more generally, assistance from the public. For instance, the enormous task of collecting information on the numerous and scattered areas of possible interest has been greatly eased by welcome voluntary help from outside the Conservancy. At present, eleven "declared" reserves, totalling some 23,000 acres, are being managed, and fifteen or twenty more are in various stages of negotiation. It is expected that ultimately there will be about a hundred of these reserves, apart from small geological sites. They will include a wide range of different types of country, from cliffs to marshes, from woodland to moors ; but all will be "undeveloped" and uncultivated, though a certain amount of grazing land will be included.

Research as well as Conservation It will be appreciated that the conservation and control of natural flora and fauna mentioned in the Charter implies research as well as conservation. Except for certain geological exposures, the Conservancy is not concerned with an inert subject but with the living, changing kingdom of wild life where some 50,000 different species of animals, plants and insects compete and combine within the physical framework of rocks, soils and climate. All are part of the kingdom and none can be ignored—there is parable as well as imagination in Wells's famous story of the Martian invaders who overwhelmed human resistance with gas and fire but succumbed helplessly in their all-conquering fighting machines to the invisible bacteria of the earth's atmosphere. All contribute to the unstable equilibrium, to the shifting balance of power of their kingdom. Change is constantly taking place, but the reasons for change are far from being understood completely and are

sometimes of a most unexpected kind. " The flora and fauna of only a century ago," commented the Wild Life Conservation Special Committee in their report of July 1947, " show striking difference from those today," and they concluded that " the maintenance of any desired balance can be achieved only by a great increase of knowledge and by its skilful application". Hence, the grants given by the Conservancy to promising students for post-graduate work. Hence, too, the various research projects on which the staff of the Conservancy are now engaged, sometimes in co-operation with universities and other bodies. These include investigations into the formation of peat in the North Pennines, the red deer populations of Scotland, the plants and animals in a 10,000-acre reserve at Wester Ross, soil changes under different species of trees, and the erosion and accretion of the coast between the Thames and the Wash.

In one sense, of course, such research is an end in itself ; facts are useful things and you can never have too many of them. But in another sense, much of this research will become a means to an end, for its results will provide a sound basis for the management which is one of the principal functions of the Conservancy.

Limited Degree of Interference A nature reserve is not a " sanctuary" where nothing is killed, harried or controlled by man. Few areas in this country exist in a state of nature ; nearly all our land has been profoundly affected by human activity and is kept in its present condition by the continuance of that activity. It may be inhabited by wild plants and animals, but it owes its present form to such human action as the pasturing of cattle on the hill grazings and the mowing of fenland, without which the one would return to bracken, the other change to scrub. In most reserves, therefore, the Conservancy will be dealing with what are, at best, semi-natural conditions—namely, communities of plants and animals held in relative stability by the continuance of a limited degree of human interference. On the management it exercises will depend the continuance of that limited degree of interference which gives a particular area its particular interest.

But management by the Conservancy differs radically in aim, and therefore in methods, from the system which obtains on the ordinary estate. A forester, for instance, is primarily concerned with the production of timber ; his trees are certainly a crop, probably an amenity as well, and he subjects the area to a specialized, artificial type of treatment designed to benefit a limited number of plants and animals. All other species are either ignored, controlled or, if possible, exterminated. But the biologist regards *his* trees as the framework of a home wherein dwell a variety of different species of plants, insects and animals, each one of interest in its own right. He is concerned with the environment they create and the various forms of wild life that take advantage of it ; the trees have become a background, not a means of output. Every man to his trade, and those accustomed by training and habit to regard the land as a place where things necessary for human life or comfort are grown should remember that the apparently neglected woodland or the seemingly derelict heath which belongs to the Nature Conservancy is in reality being managed as skilfully as his own farm—but it is being managed in a different way for different purposes by men of a different profession. Minor but inclusive Whipsnades, animated ecological history and permanent works of geological reference—these are the "crops" of the Nature Conservancy, and the cultivator of the soil is among those who will in due course benefit from their harvest.

PLANNING FOR WILD LIFE IN OUR FORESTS

E. LEPP, DIP. HORT. AND LANDSCAPE
King's College, Newcastle-upon-Tyne

Conscious of the diminishing refuges for wild life in the countryside today, Mr. Lepp makes a strong plea for our man-made forests to be designed for the encouragement of wild mammals, birds and fish, as well as for the growing of timber.

WITH the increasing mechanization of our agriculture and forestry, the displacement of hedges and hedgerows by wire fencing and the merging of small spinneys and copses into larger woodlands for the purpose of softwood timber production, the loss to wild life of suitable shelter and feeding (the food often being too monotonous) is a matter of serious concern. Take woodland birds first of all. In my view the majority of them are, on balance, beneficial to forest life. In return for their shelter and food, the birds protect the trees throughout the year by constantly attacking their enemies, thus offering the cheapest and most natural means of ensuring forest health and conferring an indirect benefit on our farms and gardens. The green oak-leaf roller-moth caterpillar, which defoliates the oak in midsummer, is hunted extensively by starlings and rooks. Woodpeckers usually feed on wood-boring insects. The cuckoo is one of the few birds which eat hairy caterpillars. The bigger birds—owls, hawks, kestrels crows—destroy forest rodents.

A large number of game-birds have also made the forests their homes—pheasants, black grouse, woodcocks, capercaillies, partridges and snipes, likewise wild duck, geese and swans. It should be remembered, however, that some game-birds are harmful to forestry; black game and capercaillies, for instance, which eat a prodigious quantity of young pine shoots.

Various kinds of deer (red, fallow, roe, etc.) also live permanently in our forests. They, too, attack forestry trees (bark, butts, leaves and shoots), particularly when their number exceeds the feeding capacity of the area; they trample and uproot young seedlings and plants, and strip the bark with their antlers. The rabbit is, of course, a real menace, not only to our forests, but our farming land too. It attacks every tree, with the exception of the elder, and it is thought that it is responsible for the disappearance of the Scots pine from the southern parts of England. The rabbit must be treated as vermin and every step taken to exterminate it. Its natural enemies—foxes, weasels and stoats—should be protected and their breeding encouraged. The raiding of poultry-yards by foxes could more often than not be prevented by proper attention to hen houses and runs. The damage caused by brown and mountain hares is very similar to that done by rabbits, but, being fewer, their harm is felt less.

It is still possible to find under the canopy of forest trees a whole series of smaller forest animals: martens, otters, polecats, squirrels, moles, bats, hedgehogs, etc. Some of them are useful (moles, hedgehogs, bats and martens) others, like grey squirrels, harmful to forest life. The grey squirrel is now regarded as being as great a menace as the rabbit, and an all-out campaign against it has been launched by the Ministry of Agriculture and the Forestry Commission. Britain's grey squirrel population has been estimated at about 1,500,000. It feeds mainly on young shoots and the eggs and young of many useful birds, and if its present rate of increase continues it will be

virtually impossible to grow commercial crops of beech, sycamore and oak in this country.

The forest is the mother of the natural watercourses and of water accumulations. Without appropriate microbial life and fish life, the water would be dead, and one of the forester's tasks is to help keep the water alive. Salmon and trout fishing and allied trades can make a substantial income for many forests based on commercial return.

Woodland Life and Forestry Interest For some time there has been a great interest in the rehabilitation of British woodland life. Fishing and game-shooting have played a great part in the history of British forests. Unfortunately there is a belief, which is shared by some foresters bearing in mind the harm caused to forest trees by wild animals, that game preservation and forests based on economic foundations do not go together. But there are always means of keeping the animals within bounds so that no conflict arises. They can, if necessary, be shot or trapped, and protection given to their natural enemies who can be fed artificially during the lean winter months. Forests with a fair proportion of animal life (for instance, one deer per 100–150 acres instead of one for 10–15) are ideal. Such forests offer grand opportunities for outdoor recreations such as camping, fishing and hunting, and also enjoyment for the casual nature-lover. To achieve this, we must encourage certain forest animals to come and live in our woodlands. We must learn their ways of life, we must attract them with food and offer them nesting and living facilities in the right environment; but we must also be prepared to control their numbers if they become a menace to forest trees.

The majority of our song birds—mainly insect-eaters—live in hedgerows, copses and forest fringes. They like wide rides and open glades and prefer trees or tree groups with an undergrowth of shrubs. Crossbills, tits, titmice, etc. prefer to live in old pine woods. Douglas firs, Norway and Sitka spruces are often the nesting places of crested wrens. The fir trees are preferred by the long-eared owls. Woodpeckers are fond of nesting in dead trees. Wild pigeons and doves (both harmful) normally frequent the areas of heavy mast. In woods and their immediate vicinities, used as hunting grounds, live the cuckoos, nightingales, warblers, wagtails, etc. as well as the bigger birds—buzzards, kestrels, merlins, carrion crows, ravens, etc. Our game-birds dwell in forest fringes (black game), in mixed woodlands of various ages interspersed with small glades (common pheasants and black grouse), and in old pine forests (capercaillies). The areas inhabited by the water-birds are the forest ponds, lakes, brooks and streams.

Forests contain a number of game-animals that normally feed on herbs, grass and fruits. As a rule, they prefer to spend the day-time in woodlands, coming out at dusk or in the early morning to look for food in nearby fields and forest glades. The harm caused to young forestry trees is negligible, so long as the animals can obtain their food (deer grass, for instance) without difficulty. Since forest trees are attacked mainly in winter, when there is a shortage of animal food, the toll taken can be minimized if a good supply of nourishment is provided in suitable places. Hares, for instance, attack the young trees when snow covers the ground. To feed them, it is often sufficient to fell a couple of aspens. If all the precautionary measures previously mentioned do not prove successful, and the number of animals becomes greater than the feeding capacity of the area will carry, corrective measures could be undertaken at the earliest possible time to avoid damage to the trees.

Suitable Sanctuaries Permanent forests can provide a lasting sanctuary and a favourite home for our various wild animals—mammals, birds and fish. These include forests on hill tops (shelter) and their slopes (protection against erosion), in water catchment areas (water storage), on the fringes of commercial woods (protection against bad weather), in the vicinity of artificial water reservoirs (screening purpose), along roads and streams (used for decoration and firebreaks), on sand dunes (soil improvement) and sea beaches (elimination of landslides), including woodlands of historic value, for example, the Forest of Dean and the New Forest. There are, throughout the British Isles, substantial areas of derelict land which for various reasons can neither be farmed nor afforested economically, but which could easily be converted into excellent wild-life refuges. There are plots of ground where even grass does not grow satisfactorily, but on which bird sanctuaries could be established on a smaller scale. Most suitable for this purpose are small groves of mixed trees, with an undergrowth of shrubs (preferably spiny and thorny), open on all sides, located amongst agricultural land and, if possible, in the vicinity of farm buildings, near brooks, streams and along roads. Single trees in poultry-yards and on pasture lands are also an encouragement to bird life. Among the trees recently introduced in great numbers by the Forestry Commission, the Norway and Sitka spruces and the Douglas fir provide the most favoured nesting sites of many small birds. The large close stands of trees or forests spreading out over several square miles do not encourage bird life. In such woodlands, open glades should be left where tree growth is not economical—that is, where the ground is too rocky or too peaty. The woodlands consisting of uneven stands (coppices, coppices with standards, selection and group systems) are most favourable to bird life.

The nesting birds are the best woodland hunters, and any additional food and shelter which can be given to them would greatly increase their number and useful work. Thus when clearing areas of old timber, care should be taken to retain some old trees, with natural hollows suitable for nesting purposes and frequently used by birds such as barn-owls, woodpeckers and starlings. In commercial forests under cutting, where such trees are lacking, some fairly large trees with large trunks should be selected and left standing in the spots preferred by birds, and used for setting up artificial nesting places and nest-boxes.

The forest fringes of existing woodlands, particularly when they are based on commercial foundations, should be underplanted with shrubs and shade-giving trees (both preferably thorny), which would offer better nesting facilities to many useful birds showing a preference for such forest borders. For the same reason, when forest parks are established it is advisable to keep their boundaries as long as possible and to plant hedges of natural growth to eliminate the short-cuts or to conceal the single open spaces (glades and picnic sites) from each other.

Game Coverts The oak-hazel coppice has mainly been used in the southern counties of England for two purposes: timber production and game coverts. Its commercial value is very low, and as permanent game coverts the coppice must receive more care and be properly managed: forest glades should be made, fruit trees and berry shrubs introduced, and broad-leaved evergreens or even coniferous trees mixed with standing timber.

In afforestation areas it takes years before the new plantations are able to supply wild animals with food and cover. It would, then, be advisable to retain and rearrange as game preserves some plots of coppice, in spite of their inability to produce first-class timber. This rearrangement should be used

without hesitation in areas where the shooting and hunting rights (rents) are high enough to make up the losses suffered on account of the poor quality of the timber.

The selection system is without doubt the best and most suitable method for game coverts, but as it makes forest management more complex, and possibly more costly, it can be adopted only where the continuity of forests (elimination of floods, soil erosion and water catchment areas) and its wild life are most important, and economic considerations are secondary.

The group method takes second place as a game covert. Forests managed under this system, similarly to the selection method, will never get entirely bare. Felling is confined to the removal of a number of mature trees scattered throughout the forest. The group system or the distribution of groups also provides some excellent nesting facilities. The young plantations up to ten years old are the most suitable and give the best coverts.

Widespread and unaesthetic clear-cuttings should be banned, especially in those forests which are used as game coverts. If this system were used as a basic method in forestry management, the forest rotations should not be established on a large scale but be broken up into small ones and sited in such a way as to scatter them as much as possible throughout the whole area under afforestation. Once felled and re-established, these forests will greatly resemble the group system (stands of different ages), so favouring wild life and not interfering so much with landscape functions. Also, it may be that here and there some form of screen and shelter—shrubs in groups of ten to twenty plants—can be planted along forest fringes, forest roads, etc., at intervals of between 60 and 100 feet. This forest treatment would make possible the provision of better nesting and roosting places for our game-birds.

Where agricultural crops are liable to suffer from the ravages of wild animals, such as deer and rabbits, the boundary line between the farmland and afforested areas should be as short as possible.

Water Life Clean water is the first and most essential requirement in the breeding and nursing of fish and other useful water life. The building of dykes, dams, the diversion of river-courses, the drying out of their short reaches and the destruction of sedges have caused much harm to water-fowl and fish life; all these changes contribute to the diminution of nesting and spawning places and reduce the living space of wild life. First of all, it is obvious that anything which can affect the purity of the water and is likely to become a menace to water life should be eliminated from the vicinity of watercourses. It is only when this is achieved that it will be possible to tackle the problems closely connected with fish breeding; to improve the old spawning places, create new ones, build fish ladders, plant trees and shrubs which are essential to secure the welfare (prevention of erosion) of the natural watercourses and their teeming life. Wherever practicable, the banks of rivers, lakes, etc. should at least be covered with grass, and those with a more or less constant water-level should also be planted with shrubs and trees. The planting should be carried out in such a way that the exchange of cold and warm air between land and water is not impeded through the wrong location of plants; gaps and vistas should be left to further this interchange. Special attention and care should be given to river mouths, estuaries and the banks of tributaries in places where they are in danger of being washed away, and if necessary ground alterations should be undertaken so that the endangered areas can be clothed with grass and protected by tree roots.

Planting The plant materials used are of two kinds: first, those which will produce nourishment, and secondly, shrubs and trees which will provide shelter—that is, better nesting and roosting facilities. The first group includes berry shrubs and fruiting trees. It is made up of oak (acorns which are one of the most important game foods and are eaten by beavers, foxes, pheasants, ducks, grouse, etc.), crab-apples, mulberries, cherries, and plums. Mountain ash or rowan, beechnuts and horse-chestnuts are often sought after and consumed by different ground game (red deer, foxes, martens, etc.), and by various birds. We should add to this list the white beam, service tree, Swedish white beam, wild service tree, thorns, common buckthorn, common and red elder, wild roses, privets, Chinese box thorn, cotoneasters, honeysuckles, brambles, raspberries, currants, gooseberries, etc.

Plants of native origin, accustomed to the conditions of the forest, are a first choice, as they are more resistant to woodland competition. The existing flora and the composition of wild stock will influence the choice of the shrubs and trees species to be introduced. Shrubs and trees grown chiefly for crop and food need the best location (soil, moisture, light, etc.) to be able to produce their crop not only in years of general glut but also during extreme shortages caused by spring frosts, summer droughts or even plant pests (insects and fungi). They can be planted on the forest fringes, wider rides, open glades, along forest roads or mixed with forest trees.

Most of the crop trees have attractive flowers: wild cherry, bird-cherry, cherry plums or myrobolan, crab apple, or even horse chestnut. They have great ornamental value, particularly when they are planted in front of dull green coniferous trees. Generally, they should be grouped in such a way that the resulting landscape effect will look quite natural. In places where groups of trees cannot be established, single trees planted on pastures, in hedges, etc. should be considered.

To the second group belong chiefly the conifers, whose seeds are frequently consumed by birds, and shrubs and trees of spiny character. When the selection is made, the following conifers should be chosen: Norway and Sitka spruces, Douglas fir, grand fir, European silver fir, (light soils), Serbian spruce in areas of severe cold, Western red cedar, Western hemlock, redwood and yew, all of which provide a first-class undercover. The species most resistant to wind—Sitka spruces, Western hemlocks and Monterey cypresses—can be planted as single trees or, preferably, in small groups (three to five trees).

We can also use for shelter broad-leaved evergreens which are generally useful as food producers: holly, evergreen oak, Cork oak (only in south-western parts of Britain); aucuba, which thrives in shade and even in places where no grass will grow; evergreen spindle tree, shallon (excellent in moist and shady places); Oregon grape (one of the best ground coverers), cherry laurel, pyracanth (a thorny shrub), and rhododendrons.

The selection of shrubs and trees of spiny character which are primarily intended to protect nesting and roosting places against unwanted visitors and intruders, should include specimens such as wild roses, thorns, sea buckthorn, common buckthorn, barberries, Chinese box thorn, honey locust, and false acacia.

The selection of trees for districts menaced by floods or for use on riverbanks and river estuaries largely depends on the percentage of moisture the soils contain. Soils with high percentage of water are less suitable for coniferous trees, with the exception of Sitka spruce and swamp cypress, the latter being

especially suited for swampy soils. These sites prefer mainly broad-leaved trees of the following genera: willows, alder and poplars. In southern parts of England the cider-tree (*Eucalyptus Gunii*) should also be tried out. It is the sole evergreen broad-leaved tree of timber value which does well on low-lying land.

It is advisable that all these shrubs and trees, as long as they are young, should be protected by wire netting or fencing against rabbits, and perhaps against deer and domestic animals.

Good forest management, like good farming, may be judged by its vigorous animal stock. This goal can be achieved only if proper care is given to the establishment of protected areas for feeding and nesting, and to the planting of sheltering and food-producing shrubs and trees in our new forests.

THE FIRST NATIONAL WEED CONTROL CONFERENCE

J. F. ORMROD, B.SC.
Department of Agriculture, University of Oxford

Our knowledge of the use of chemicals for the selective control of weeds has increased rapidly during the last few years, and is now marking out for itself a field of study comparable to that concerned with the economic aspects of insects and fungi.

UNTIL recently, there has been no meeting ground for the practitioners of the new science of weed control where the most recent developments could be reviewed and ideas exchanged. This need was met by the first National Weed Control Conference, held at Margate on November 3–5, 1953, which was organized by a committee representing the Ministry of Agriculture, the Agricultural Research Council, The National Farmers' Union, The Association of British Insecticide Manufacturers, and the British Agricultural Contractors' Association. A permanent organization has now been formed with a wider representation, and further conferences will be held from time to time.

Twelve formal papers and thirty-three research reports were presented at the first conference to over 300 members, including official and commercial research workers, technical representatives, spraying contractors, advisory officers, farmers, and visitors from overseas. It is not possible in the space available to indicate even the scope of all these papers, but a few of the points from the research reports which are of more immediate interest to farmers can be mentioned. The papers, reports and discussion are being printed in full in the Conference Proceedings*, which it is hoped will be published this month or next.

*To be obtained from the Joint Secretary, Mr. W. A. Williams, Association of British Insecticide Manufacturers, 166 Piccadilly, London, W.1. (address after March 1—Cecil Chambers, 86, The Strand, London, W.C.2.).

Weed Control in Cereals and Undersown Cereals MESSRS. J. D. FRYER and J. G. ELLIOTT reported on thirty-five experiments carried out over three years, which showed that there was no difference in effect on the crop between low-volume rates of 7 gallons per acre and high-volume rates of 80 gallons per acre. They had confirmed that 2,4-D amine was safe for use on spring wheat and barley at the recommended rates and stage of growth, but showed that it should not be used on oats at the usual spraying time. They suggested, however, that it might be as safe to spray spring oats with MCPA and 2,4-D when the crop has one or two leaves as at the much later stage now recommended. If further work confirms this, some weeds now considered resistant—for example, redshank and mayweed—might easily be controlled in oats. MR. E. B. SCRAGG showed that some oat varieties are more liable to be damaged by MCPA and 2,4-D than others, though more information is required before practical help can be given to the farmer. MISS M. H. MYERS gave a paper of great interest to those engaged in research work in this subject, but one point emerged of potential practical value to farmers and spraying contractors. She stated that abnormalities appear on spring cereals only if spraying is carried out before the six leaf stage, and on winter cereals before the seven-leaf stage. (This refers to the leaves on the main stem, including those at the base of each tiller, but not to leaves borne on the tillers themselves.) If this is confirmed, it may be a useful rule-of-thumb guide to the correct date of spraying, in place of the present very vague "fully tillered stage".

Three reports were made by MR. SCRAGG, MR. K. HOLLY and MR. W. OCHILTREE on the problem of spraying undersown cereals with MCPA and 2,4-D—a practice which is becoming more common, even though a risk to the clovers is involved. All three papers agreed that 2,4-D is much more damaging to red clovers than is MCPA. Any difference between the two compounds in their effect on white clover is very small, but there is some evidence that on occasions MCPA is slightly more toxic to seedling white clover than is 2,4-D. Scragg suggested that late-flowering red clover is slightly more susceptible to damage than broad red, and wild white clover slightly more than S.100. Holly reported that there was no difference between high- and low-volume rates in their effect on red clover when applying pure 2,4-D amine and sodium MCPA, but considerable damage to the clover occurred in the same experiment when using a commercial MCPA product at low volume. Ochiltree reported eight experiments on established and seedling grass and clover leys which showed that, although there is an initial depression of clovers after spraying, the clovers usually recover quickly. One experiment indicated that clovers sheltered from the spray by weeds or other cover are less likely to be depressed than those fully exposed.

Weed Control in Grassland Two papers reported on the use of dinoseb (DNBP) for control of annual weeds in direct-sown grass and lucerne leys. MR. F. E. ALDER found that 1½–3 lb. per acre dinoseb gave successful control of low-growing weeds, such as chickweed or knotgrass, which could not be controlled by mowing, and that white clover could be sprayed as early as the one-two trifoliate leaf stage. MR. J. F. ORMROD reported yield increases in five out of seven experiments following dinoseb spraying of lucerne at the four-leaf stage: the average yield increase over all the experiments more than covered the cost of spraying.

In view of the large area of rush-covered land in the British Isles, many farmers will be interested in the successful control measures described in

four papers on this subject. MR. A. LAZENBY dealt with the establishment of rushes from seed and showed that the competitive effect of different grass species varies tremendously, and that rush seedlings could only become established where there was moisture at or near the soil surface. MESSRS. J. G. ELLIOTT, S. CAMPBELL and A. J. DAVIES showed that the common rush (*Juncus effusus*) can be controlled satisfactorily by spraying about 2 lb. of 2,4-D or MCPA in May or June, combined with mowing over the rushes and subsequently managing grassland well. There was some difference of opinion whether cutting immediately before spraying is beneficial, but there was ample evidence that spraying uncut rushes and mowing over a month after spraying gives good results. Elliott reported that the hard rush (*J. inflexus*) was rather resistant to MCPA and 2,4-D. Campbell showed that under favourable circumstances cutting alone, followed by intensive grazing, brought about an appreciable reduction in rushes, and that unless spraying is followed by good grassland management, there is a tendency to reversion in later years. MR. T. H. DAVIES reported that spraying rushes before ploughing and reseeding prevents the reinvasion of the ley by growth from partially buried rush clumps.

Ragwort is a poisonous scheduled weed and a curse to farmers on some soils. Two papers showed the seriousness of the problem and indicated possible means of control. Mr. A. J. Davies reported that ragwort is a serious problem in south-west and north-west Wales and kills many more cattle and horses than had been suspected before a recent survey. There is evidence that sheep grazing keeps the weed under control. Mr. Fryer reported on twenty experiments which showed that 1–4 lb. of 2,4-D prevented all flowering a year after application, but that reinvasion by seedlings frequently occurs, so that spraying for several years might be necessary to achieve permanent eradication.

Mr. Holly reported on six experiments which showed that spraying with MCPA, 2,4-D or 2,4,5-T cannot be expected to give permanent control of *Equisetum* (marsh horsetail or snakepipe), though most shoots present at the time of spraying are killed with the recommended dosages.

Other Weed Problems MR. C. PARKER described experiments on pre- and post-emergence weed control in sugar beet. Mineral oils fortified with PCP gave encouraging results when applied before crop emergence. Post-emergence treatments with sodium chloride and nitrate plus a wetting agent were successful when the weeds were small and the beet had at least two true leaves, but fat-hen and orache proved resistant.

MR. A. L. ABEL reported on experience with control of couch and other grasses, using TCA. In uncropped land a substantial reduction of couch grass (but not a 100 per cent kill) had been achieved by ploughing and cultivating, spraying 20 lb. per acre TCA, waiting two to three weeks, then cultivating and applying a further 20 lb. of the weed-killer. Higher rates did not give an economic increase in the degree of control. For selective control of grass weeds in crops, 20 lb. of TCA per acre seemed to be a promising treatment for sugar beet, established lucerne and linseed.

FARMING AFFAIRS

Deficiency Payments for Home-Grown Cereals of the 1954 Harvest

Seasonal standard prices for wheat and certain other points connected with the Deficiency Payments Scheme for home-grown cereals of the 1954 harvest are announced by the Agricultural Departments of the United Kingdom and the Ministry of Food.

The broad principles of the Scheme were outlined in the White Paper (Cmd. 8947). The detailed arrangements for the 1954 harvest have now been worked out in consultation with the farming and trade interests.

Two leaflets for farmers, one giving information about the arrangements for *wheat* and *rye* and the other for *oats*, *barley* and *mixed corn*, have been prepared by the Agricultural Departments and are available free from County Committee offices. An announcement on the procedure for claiming deficiency payments will be made later.

Report of the Working Party on Agricultural Education

The Working Party under the Chairmanship of Lord Carrington was appointed in November 1952 by the Minister of Agriculture and Fisheries after consultation with the Minister of Education.

In their report now published (H.M.S.O. price 9d.) the Working Party say that there is scope for improvement in the existing co-operation between the agricultural education services of Local Education Authorities and the National Agricultural Advisory Service, and they make recommendations designed to secure this.

They also recommend the early establishment of arrangements for the inspection of agricultural education which they think should be undertaken by suitably qualified inspectors of H.M. Inspectorate with specialist assistance where necessary.

A further recommendation is that the Joint Advisory Committee on Agricultural Education (the Loveday Committee) in its present form should lapse but should be reconstituted as necessary for specific inquiries.

Farming is a Business

We are living in a rapidly changing world, and developments that are now apparent are bound to have a profound effect on the farming industry. Farmers have seen a period of prosperity in recent years, even though that prosperity was achieved under difficult conditions. They were called upon to make a tremendous contribution to the production of food at a time when many of the essential resources of the farm—labour, fertilizers, feedingstuffs and, from time to time, machinery—were restricted or difficult to obtain. Nevertheless, it was an era when moderate efficiency produced a substantial reward for effort expended.

These conditions came into being as a result of the country's siege position during the war, and subsequently because of the world shortage of food and Britain's difficult financial circumstances. Prices to farmers were guaranteed at a high level and an assured market was established for the whole of our domestic production, irrespective of quality.

With regard to the world food market in general, there can be no doubt that as far as one can see into the future the prospects are of a continuing shortage. In spite of this, however, world surpluses of certain food commodities, such as grain and eggs, have already occurred in dangerous quantities in North America. Moreover, world commodity prices are falling everywhere, and it is thus only natural for the British farmer to wonder what the future has in store for him. One thing is clear—maximum food production can no longer be regarded as an end in itself. While no

one will deny the continuing need for increased food production, that increase has got to be achieved as efficiently as possible; in other words, higher output must be obtained at a price the consumer can afford to pay. With freer market conditions and a stronger manifestation of consumer influences, the farmer can no longer rely solely on the physical and technical factors on his farm. He must now be prepared to study and react to influences outside the farm boundary; he must take account of price trends and consumer tastes and requirements. The business aspects of farming are, in fact, essential factors in the building up of a high profit-yielding farming system.

The farmer now has a vast fund of technical information available to him —the result of many years of scientific research—but before adopting any suggested course of action or technical innovation, it will be necessary for him to calculate the effect that it will have on the farm as a whole and on his net farm income in particular. He must co-ordinate technical knowledge with economic principles to achieve the highest continuous profit rather than maximum profit in any one year. Only thus will he succeed in maintaining the fertility of his land whilst obtaining the best financial reward for his efforts and resources.

W. Emrys Jones

Farming Cameo: 38. Southern Radnorshire

South Radnorshire, one of the three N.A.A.S. districts in the county, is bounded by Brecon in the south and Hereford in the east. It has no towns of any size and, apart from Builth Wells, the markets are over the border in England. Indeed, the farming of the area has been greatly influenced by the demands and proximity of the midland counties. The countryside is totally unspoilt since, apart from one small quarry, the district is wholly agricultural. The main farming system centres around the production of Hereford store cattle and sheep. Milk production has not become popular, except for small pockets on the low-lying land.

Topographically, this district is rather difficult. Apart from the narrow belt of relatively low land in the valley of the well-known River Wye, the land rises sharply to well over 1,200 feet, and the majority of the farms lie at over 800 feet. Soil types fall into three main groups: in the extreme south there is a belt of Old Red Sandstone, in the north a belt of heavy soil on a clay subsoil and, in the centre, forming the greater part of the area, there is a light soil with a shale or gravel subsoil.

Within the twenty-six parishes of the area there are approximately 65,000 acres of enclosed land, which includes about 12,000 acres of tillage. The main arable crops are oats, barley, wheat and roots. A considerable part of the rootbreak is given over to rape, which serves admirably as a pioneer crop in the reseeding of the rough grazings. The introduction of rape has resulted over the years in a new development in the area—the production of fat lambs. Formerly, nearly all sheep were sold as stores.

In the Wye valley, where the rainfall is lower, a Seed Growers' Association has been operating for a number of years, and although the acreage devoted to seed production is small, valuable work has been done in the production of Aberystwyth strains of grasses and cereals. A vigorous Seed Potato Growers' Association has also been in existence for a number of years. Members of the two enterprises are drawn from Breconshire as well as Radnorshire.

One very interesting feature of this district is the extensive area of rough grazing, which is mainly covered with bracken. Over 13,000 acres of rough grazing lies within farm boundaries and 12,000 acres are open common grazing. The soil on the greater part of the common rough grazing land,

lying at an altitude of 1,000–1,450 feet, is deep and ploughable. Over 1,000 acres of this land were brought into production during the war and have since been reseeded and returned to the Commoners. This experience has shown that these bracken-infested common hills, with their deep and easily ploughable soil, are capable of producing over 10 tons of potatoes or 25 cwt. of oats and barley to the acre and, when reseeded, of carrying the equivalent of one matured beast to the acre during the summer months. The high rainfall often makes harvesting difficult and hazardous, while the exposed nature of the land, together with the long and severe winter, renders the wintering of stock one of the most difficult problems. Nevertheless, the success achieved on these hills during the war has encouraged most farmers to improve the enclosed rough land, and considerable acreages are being reclaimed every year.

The sheep population of the district is now about 14 per cent above pre-war, while cattle numbers have risen by about 5 per cent. The June 1953 figure for all cattle was just over 13,000, including 4,600 breeding stock. Hereford and Hereford crosses are the most common breeds of cattle, and multiple suckling of calves is the exception rather than the rule. The main sheep breeds are the Welsh-Kerry cross and, in some cases, the Welsh-Clun Forest cross. There are also a number of first-rate Clun Forest flocks. In most cases, especially where farmers have unrestricted hill rights, it is the practice to sell off the one- and two-year-old breeding ewes every year and then buy in hardier replacements.

The present tillage acreage is about double that before the war. The increase in stock numbers and the marked improvement in the quality of stock, as compared with pre-war days, has been largely brought about by a greater concentration on the management of grassland and by a policy of reclamation of rough grazings. One of the greatest limitations to production, however, is the bad state of farm buildings, although grants under the Hill Farming and Livestock Rearing Acts have helped considerably in this direction.

In spite of the vagaries of weather and the great disaster which befell the area in the 1947 blizzard, the present state of farming in southern Radnor is a credit to the farmers, who, even at the best of times, have to work under many difficulties.

S. L. Church,
District Advisory Officer

Wise Stock Feeding: 12. Pig Feeding Since the control of animal feedingstuffs was lifted in August 1953, many farmers have bought their own "straights" and are mixing pig rations on the home farm to reduce costs. Some pig-keepers are reverting to all-meal feeding, since it is easier and makes less demand on labour. For the latter category the following meal mixtures are suggested:

Meal A. Sow and Weaner (For breeding stock and young pigs 8-18 weeks old)

	Ration 1		Ration 2		Ration 3*
	per cent		*per cent*		*per cent*
White fishmeal	10		7		5
Extracted decorticated groundnut meal or soya bean meal	–		7		10
Dried grassmeal	5	*or*	5	*or*	5
Minerals	–		2		2
Cod liver oil (or its equivalent)	1		1		1
Weatings	25–30		25–30		25–30
Ground cereals	59–54		53–48		52–47

*Unless supplies of animal protein concentrates are very short, this mixture should preferably not be used for breeding stock.

Meal B. Store Pigs (18–24 weeks old)	*per cent*		*per cent*
White fishmeal	–		5
Extracted decorticated groundnut meal or soya bean meal	8		–
Dried grassmeal	5	*or*	5
Minerals	2		2
Weatings	25–40		25–40
Ground cereals	60–45		63–48

Meal C. Fatteners (24 weeks to slaughter)	*per cent*
Dried grassmeal	3
Minerals	2
Weatings	25–40
Ground cereals	70–55

Meal D. Pig Starter Food (3–10 weeks old)	*per cent*
White fishmeal	10
Extracted decorticated groundnut meal or soya bean meal	5
Dried milk products	5
Dried grassmeal	5
Flaked maize	20
Cod liver oil (or its equivalent)	1
Weatings	20
Barley meal	34

The ground cereals in the above rations will usually consist largely of barley meal, but maize, oats and wheat can be used successfully. The maximum amount of each of these cereals in the meal mixtures given should not exceed the following:

	Percentage of Total Ration	
	Meal A	Meals B or C
Oats (finely ground)	25	35
Wheat (coarsely ground)	25	30
Maize meal or flaked maize	40	20

The dried grassmeal should be of good quality and contain at least 15 per cent crude protein; the minerals should consist of 3 parts ground chalk and 1 part common salt. White fishmeal can be replaced weight for weight by by whale-meat meal suitably mineralized, provided it contains 60 per cent or more crude protein. Where cod liver oil is used, it should first be mixed with some of the weatings: in this connection, it is useful to remember that 1 pint of oil weighs about 1 lb. Vitamin A and D concentrate can now be obtained as a dry meal to replace cod liver oil, the usual rate of mixing being 5–10 lb. per ton of pig meal.

Young pigs from 3 weeks old should be allowed free access to Meal D, offered dry behind a creep, and water should always be available. By weaning time, the pigs should each be eating 1½–2 lb. meal daily. If possible, feeds should be given three times a day for at least a month after weaning, a gradual change being made in the first fortnight to Meal A. After weaning, the daily amount of meal fed should be increased by ¼ lb. per pig at the end of every week up to a daily maximum of 6 lb. per pig at about 25 weeks old. Alternatively, a more flexible system, which works very well in practice, is to feed the pigs to appetite from weaning to 16 weeks old by allowing them at each feed as much meal as they will readily clear up in about 15–20 minutes. From 16 weeks the daily meal consumption should be increased each week by ¼ lb. per pig until the 6 lb. daily maximum is reached. Thereafter, with both systems of feeding, a fixed daily allowance of 6 lb. meal should be fed until slaughter. The meal fed should be changed at 18 weeks from Meal A to Meal B, and at 24 weeks from B to C. As with all stock, the change in ration should be made gradually over the course of several days.

Where dry meal feeding is practised, pigs should have access to water at all times. With wet feeding, young pigs from 8 to 18 weeks old should receive about 3 lb. of water to 1 lb. of meal fed, this rate being gradually

reduced to 2 lb. of water to 1 lb. of meal as slaughter weights are reached. A good system is to put the dry meal allowance in the trough and immediately add the necessary quantity of water. A good, thriving bacon pig should eat little more than 6 cwt. of meal from 3 weeks old to slaughter, and a good target to aim at in practice is 1 ton of meal for every 3 finished pigs.

During the first three months of pregnancy in-pig sows should receive 4–6 lb. of Meal A per head, according to their condition and the amount of grazing available, while for the fourth month 6–7 lb. could be fed. In the week prior to farrowing, between one-third and one-half of the meal allowance should consist of bran, to avoid constipation. A few days after farrowing, the meal fed should be increased gradually by about 1 lb. per day to 10–16 lb. A useful rule is to feed up to a maximum equal to 3 lb. of meal for the sow plus 1 lb. for each piglet. A week before weaning, the sow's meal allowance should be reduced gradually so that, at the fifty-sixth day, when she is finally removed from her litter, she is receiving only 4–5 lb. of meal a day. Breeding stock should always have free access to clean, fresh water.

Finally, mention might be made of the use of dry self-feeders for pigs. Pigs will undoubtedly make rapid liveweight gains when put on a self-feeder after weaning. To prevent excessive consumption of meal and to ensure good carcass quality, it is advisable, however, to take the pigs off the self-feeder at about 100 lb. live weight (at approximately 16–18 weeks old) and thereafter limit the daily meal consumption to a maximum of 6 lb. per pig. If antibiotics are used, the maker's recommendations should be carefully followed—thorough mixing with the meal being essential. To give antibiotics a fair trial, they should be fed in the creep feed from 3 weeks and continued right through to slaughter. Discontinuance at an earlier age may mean a subsequent reduction in growth rate. On no account should antibiotics be fed to breeding pigs.

C. D. Rickaby

World Production of Butter and Cheese With the announcement of the forthcoming derationing of butter and cheese, it is interesting to look at the figures on world supply and demand in respect of these commodities given in the Commonwealth Economic Committee's latest review*. In 1952 butter supplies reached a new low level, due mainly to a rise in the consumption of liquid milk, higher output of cheese and processed milk, and an increased demand in producing countries, notably Australia. In consequence, United Kingdom imports were little more than half those of 1938, and consumption fell to 11 lb. per head—that is 13 lb. less per head than before the war. This, in turn, led to a record consumption of margarine—the actual figure being 19 lb. per head. The butter position in 1953 was, however, much brighter. Milk production once more attained the 1950 level—the peak post-war year—and much greater quantities of butter reached the world markets.

Output of cheese, on the other hand, increased steadily over the two years. In the United Kingdom the emphasis was on production of cheese for the ration. In 1952 it equalled the 1950 level of 55,000 tons, and in 1953 it was estimated at over 70,000 tons. Even so, consumption of cheese in the United Kingdom fell in 1952 to 174,000 tons, as against an average of about 220,000 tons in the previous years.

Production of other milk products (condensed and powdered milk) continued to increase apace and is now far above pre-war levels.

* *Dairy Produce.* Obtainable from H.M. Stationery Office, through any bookseller, or from The Secretary, Commonwealth Economic Committee, 2 Queen Anne's Gate Buildings, Dartmouth Street, London, S.W.1, price 5s. (5s. 3d. by post).

Good Marketing of Home-Grown Early Potatoes A small investigation carried out last June by technical officers of the Ministry of Agriculture's Marketing Division indicates that home-grown early potatoes suffer little damage in transit either by road or rail from farm to market. Some twenty-two consignments were examined in the field from farms in Pembrokeshire, Cornwall and Lincolnshire, and subsequently seventeen in markets (mostly at Birmingham, and a few at Nottingham and London). The produce was in transit between 12 and 36 hours.

On the farm the principal defects were "skinned" tubers (27 per cent), and potatoes showing other forms of more serious mechanical damage such as cuts and bruises (6.7 per cent). At markets the skinned areas injured at the farm had healed over, and only 3.7 per cent of freshly skinned tubers were found; other mechanically damaged tubers averaged 7.1 per cent. Other defects which may develop after harvesting and packing and subsequently affect the condition of the potatoes, include "browning", heating and various "soft rot" infections. Browning develops as the result of oxidation of the surface of skinned areas, and is most severe in hot, dry weather. Only 3.1 per cent of the potatoes showed slight browning on arrival at the market, and no instances of heating damage, which is also liable to develop in warm weather, were recorded. Weather conditions during lifting were unusually cool and moist for the time of the year, and undoubtedly helped in reducing the incidence of these defects. No damage due to soft rot infections was seen.

Most of the consignments consisted of Arran Pilot or Home Guard, and no appreciable differences in the behaviour of these two varieties were noticed. In addition, neither the method of lifting nor the package used (1 cwt., ½ cwt. sack and bushel box), appeared to affect the condition of the produce.

There is no doubt, however, that the good quality of the produce, favourable weather and quick sales gave little chance for deterioration to occur.

Long-term World Food Possibilities A continued gradual increase in agricultural production can be expected in all parts of the world over the next four years if current programmes and estimates are achieved, says the Food and Agriculture Organisation on the basis of estimates provided by member governments. These programmes suggest that for the world as a whole expansion will continue at about the same rate as in the last few years. The size of the task, however, is different for individual regions, because of the wide disparities in levels of production already achieved. The plans of governments reflect these differences. Slower progress is expected in N. America, for example, where the fastest expansion has occurred in the past and where stocks of some commodities have already accumulated.

The fastest rate of progress is planned in the Far East, where food supplies are still well below their already inadequate pre-war level, and in Latin America, where the rate of population growth is extremely high. The other regions fall between these extremes. But although the programmes thus correspond broadly to the needs of the different parts of the world and will help towards correcting the wide disparities in supplies between regions, the world food problem will remain basically as it is. In particular, even if all the plans and estimates in the Far East are fully achieved (which is by no means certain) food supplies per head in that region will still not have caught up with the pre-war level and will remain far lower than in most other parts of the world.

Trees give Shelter Why is it that more shelter-belts are not being planted on farms today, especially in the more exposed districts of Wales and the north of England? The subject has been brought more forcibly to the attention of the farming community in recent years than ever before, but one can still travel for miles across windswept uplands without seeing anything more than an occasional belt planted many years ago but now often just a ragged and uncared-for monument to past enterprise. At small expense many of these old shelter-belts could once again be made useful, and the judicious planting of new belts could increase the stock-carrying capacity of the land.

To find the answer, we have to go back into history. The period 1800 to 1875 saw great activity in shelter-belt planting, pioneered by farmers and landowners north of the Border; their ideas and practices were quickly followed by some of the more go-ahead landowners in England, though in Wales a less profitable agriculture limited activity. These early improvers had little experience to guide them; their knowledge of wind behaviour was scanty and the choice of suitable species was limited. European larch, Scots pine and Norway spruce were the favourites, usually planted in long, chain-wide belts which were costly to fence and maintain. The farming depression from the 1870s to the outbreak of the last war was undoubtedly responsible for the sad neglect of these early shelter-belts and the cessation of new planting.

Today, however, the picture has altered completely. We look to our hill lands for a far greater contribution to food production than ever before, and the planting of shelter-belts is one of the ways of achieving it. Many farmers still appear unaware of the benefits which shelter belts can provide; for example, the sheltering of stock in severe snowstorms or from cold winds, the "earlier bite" of grass from sheltered areas and the protection they give to farm buildings. In some areas windbreaks have made it possible to grow early vegetables; in others, soil-blowing and erosion may be lessened. The thinnings from shelter-belts also make useful fencing materials.

Official encouragement and recognition of the need for shelter-belts was given in the Hill Farming Act, 1946, and the Livestock Rearing Act, 1951, under which a grant of half the cost of planting and fencing is available, but only one per cent of the expenditure so far approved has been for shelter-belts. Free advice is given, usually on the spot, by the Agricultural Land Service and the Forestry Commission, and the Agricultural Branch of the Meteorological Office is also prepared to help.

The Forestry Commission has a fund of experience on the right species to plant, the most suitable mixtures to use, thinning treatment and maintenance. Whereas the old species were Norway spruce and European larch, we now know these to be generally unsuitable, and Sitka spruce and Japanese larch are favoured. Similarly, meteorological research into the effect of shelter-belts on wind currents, the most suitable density for windbreaks, and their effect in snow, has increased our knowledge tremendously.

Welsh hill farmers will be particularly interested in the brochure, *Shelter-belts for Welsh Hill Farms*, recently issued by the Forestry Commission, price 2s. (2s. 2d. by post) from H.M. Stationery Office or through any bookseller.

R. W. Soden

Gestation Periods The new edition of the Commonwealth Agricultural Bureaux' table of gestation periods, compiled by J. H. Kenneth and G. R. Ritchie of the Commonwealth Bureau of Animal Breeding and Genetics, Edinburgh, will be welcomed. Many new entries have been included, a large number of them referring to additional species. The list as it now stands covers a very wide range of mammals indeed—domesticated and wild, from the agouti of the West Indies and the anoa of the Celebes to the yak of Tibet and the zebra of Africa. The price is 7s. 6d., from the Commonwealth Agricultural Bureaux, Farnham Royal, Slough, Bucks.

New U.K. Agricultural Representative in Australia Mr. C. W. Strutt will shortly be returning to the United Kingdom after a five-year tour of duty as Agricultural Adviser to the High Commissioner to the United Kingdom in Australia. He will be succeeded by Mr. Thomas Cross Creyke, who, since 1944, has been a County Agricultural Officer, first to the Lancashire and then to the Yorkshire (North Riding) Agricultural Executive Committees.

BOOK REVIEWS

The Ancient White Cattle of Britain and their Descendants. G. KENNETH WHITEHEAD. Faber. 63s.

The histories of our great breeds of cattle are mainly an account of the achievements of a few men living in the eighteenth and nineteenth centuries. They are, in a sense, stories of commercial triumph and are, of necessity, limited to fairly recent times. The pure historian would need to go back many centuries earlier for the parent material, and in the early chapters of his book, this is what Mr. Whitehead has done for the white cattle of Britain.

Many theories are reviewed, some for and others against, a probable origin from the Celtic Shorthorn (*Bos longifrons*) or Aurochs (*Bos primigenius*) or the Italian white cattle introduced by the Romans. The author himself favours the last theory, but hopes that the whole subject may again be reviewed at some future date. Anyone who undertakes this task will find his path made smooth by the detailed appendices and extensive references given in the bibliography and throughout the text of this book.

Of the three, horned, wild, white cattle herds still extant, pride of place is rightly given to the Chillingham Herd in Northumberland. Imagine a 1,100 acre park, enclosed in the thirteenth century, into which was driven a herd of wild white cattle which, over the ages, was left to breed without control. Certainly since 1795, and probably much earlier, no outside blood has been introduced, and yet the only observable effect over this long period has been a slight reduction in body size. These are cattle which will eat hay, but spurn concentrates; a herd in which bulls, cows and calves roam at will, and where man's influence has been deliberately discouraged.

On two occasions extinction nearly befell this natural heirloom. About 1760, the herd was reduced to one in-calf cow, which fortunately produced a bull calf. By the closest in-breeding numbers were subsequently regained. Again in 1947, twenty animals perished out of a total of thirty-three. Not less serious, as the aftermath of starvation, was the infertility amongst the survivors, but this, fortunately, was only temporary.

Less pure and more domesticated are the other two herds at Cadzow, Lanarkshire, and Vaynol, Caernarvonshire. Surplus bulls are castrated and the steers have a limited economic value. Formerly wild, but now fully domesticated, or near it, are the herds at Woburn in Bedfordshire, Dynevor in Carmarthenshire and Faygate, Sussex. Many others have come and gone in the last fifty years. Uneconomic as the surviving herds must have been, their maintenance over the centuries has depended upon the generosity and pure interest of their various owners. The author properly acknowledges this debt.

The fully domesticated descendants of the ancient stock were, until 1946, known as Park Cattle, but now as the polled British White Cattle. Commercially they are regarded as dual-purpose animals. Each herd is briefly described.

Although this book is relatively high priced, few pieces of research can have been more carefully prepared, assiduously studied and so thoroughly executed. Good material needs good presentation, and here the publishers are to be congratulated on an attractive binding, clear printing and magnificent illustrations; in short, a fine jewel in a fine setting.

H.E.

Lawnswood Chronicles. DAVID GUNSTON. Dent. 16s.

There can surely be few more humiliating experiences for the city dweller than to be called upon to act as guide and local historian to a visitor to his city. For only then will the unfortunate host realize how little he really knows of familiar landmarks and customs.

So it is only to be expected that when a townsman writes about the country he will observe much that escapes his country cousin. Perhaps he is eager to enjoy what he has long missed, or the countryman is too pre-occupied with the more serious business of daily living. Or can it be that, like the townsman in a similar situation, familiarity has dulled the countryman's perception? Probably the latter explains why, as the author of *Lawnswood Chronicles* records, the professional gardener had not stopped to ponder, as Mr. Gunston did, on the heights to which the wild ancestor of the runner bean might have climbed. For the same reason, it is unlikely that he would ever consciously have noticed that runner beans usually ascend their poles in an anti-clockwise direction.

Lawnswood Chronicles, taking its title from the name of the author's cottage in Hampshire, is a collection of discursive notes and essays owing their origin to an acute perception and, in the author's own words, "an inquiring mind". It is a mixed bag, and few readers will be able to suppress a chuckle over "Humour in Signposts", with its astounding collection of quaint village names, or "A Full-time Job", in which Mr. Gunston slyly questions whether the farmer's spare time is, in fact, really taken up filling in forms! Equally, other essays such as "Can a Townsman stand Country Life?" and "Does Farming Pay?", are likely to promote some serious thinking. Natural history also makes its contribution. I was particularly interested in an article on left- and right-handedness in animals. How many people can claim to know that crickets are right-handed, whereas a right-handed oyster is a rarity? But to pick out these examples for special mention is to do the book scant justice. It offers something new for even the most ardent naturalist, even if it also contains much that is well known.

The postscript to the book reads—"O, more than happy countryman, if he but knew his fortune!" Can it be that one must get away from the country to appreciate it?

Townsmen will enjoy this book, concerned as it is with the pleasanter side of living in the country. The countryman, too, will find it interesting, although to him natural phenomena occasion no surprise.

T.W.

Richmond's Dairy Chemistry (5th Edition). J. G. DAVIS and F. J. MACDONALD. Griffin. 60s.

Although it is now over fifty years since *Richmond's Dairy Chemistry* was first published, it still serves as a valuable source of scientific facts about milk. Generations of dairy students and dairy technologists will no doubt appreciate the significance of a revised edition of "Droop Richmond", but to many general agriculturists this book may not be so well known. It is divided into two parts, and it is the second of these, which includes "Analytical Methods", that is primarily of interest to the dairy chemist. Part I, which deals with the composition and physical properties of milk, milk products and ancillary products, will, however, appeal to many who are not dairy technologists. For example, the chapters concerning the constituents of milk and causes of variation in composition provide useful basic information in the present controversies concerning milk quality.

The fifth edition seeks to include new information which has been published since the last edition appeared in 1942. In some cases the new facts are tacked on to the original text with little attempt to appraise current knowledge of a particular subject, and in a few instances the reader is merely referred to literature which may not always be easily accessible to him. Nevertheless the revision covers a great deal of scientific literature, and for the time being, at least, has prevented this massive collection of information about milk from becoming obsolete.

A.S.F.

BOOK REVIEWS

Butterfly Farmer. L. HUGH NEWMAN. Phoenix House. 16s.

Mr. Newman's long-awaited excursion into the fields of professional autobiography can scarcely fail to be highly interesting, thanks to the fascinating and almost unique vocation in which he has been brought up and which he follows so successfully. People farm a good many things; very few farm butterflies and moths. Yet that is what this pleasantly anecdotal, yet scientifically serious, book is about. Reading it, one reflects that there is no limit to human ingenuity, human curiosity about nature, and human good fortune in the lifelong chase for rarities, freaks and phenomena that is the professional entomologist's lot.

The demand for live butterflies and caterpillars is very varied: private collectors want them, sometimes to set free in their grounds; zoos, film companies, schools, universities and so forth require specimens for study or display; but more important is the demand for stock in connection with research into animal behaviour and plant viruses. Among Mr. Newman's many customers, he reveals, is the Plant Virus Research Unit of the Molteno Institute at Cambridge, where larvae are sent for deliberate infection with virus diseases. The author believes that the time may come when pest control may include artificial infection of the insects in this way. It is an interesting possibility.

Naturally enough, this book is as much about personalities as about Lepidoptera, notably the author's remarkable father, who founded this strange business and whose knowledge of entomology seems to have been quite extraordinary, a handful of bizarre collectors, especially Lord Rothschild of Tring (with his enviable detachment from the world when in pursuit of rarity or entomological fact), Sir Winston Churchill, whose interest in butterflies in his Chartwell garden has already received wide publicity, and Mr. Hugh Newman himself—modest, efficient, engaging and utterly devoted to his cult. His book has many excellent photographs.

D.G.

Cerne Abbas (The Story of a Dorset Village). MARY D. JONES. Allen and Unwin. 10s. 6d.

This book contains a most interesting collection of facts, and the author has obviously gone to a great deal of trouble in her research to extract the information as to happenings, dates and persons pertaining to this village. It is all most interesting, especially to those who know the quieter part of Dorset situated in the centre of the county. It is a pity, though, that the author repeats herself so often. One point especially well brought out is the continued serenity of mind of the inhabitants of this part of Dorset over a very long period of time. The imperturbable characteristics of the ancient inhabitants of Cerne is very little different to that displayed by their descendants in the village today.

The book also illustrates the intense interest of the inhabitant in his present conditions and the fact that it takes something very much out of the ordinary to get him excited about anything outside the small world of Cerne Abbas. I remember an inhabitant of Cerne Abbas getting married some years ago and going to London for his honeymoon. After two or three days in the Metropolis he wrote to a friend in Cerne Abbas and asked him " How are things going in Cerne ? It is very quiet up here ! "

Cerne Abbas has one of the notable monuments of the country in the Giant, and interesting particulars are given about this feature. Personally, I should like to have had more information on this subject, and to have seen it illustrated by some of the local tales about him. They would, of course, have to be judiciously expurgated but even so they would, I am sure, have widened the interest in this section of the book.

The greater part of the book concerns the impact of religion on the community, particularly through the Abbey and its satellites throughout the county of Dorset. Information on this is copious and most interesting. In short, this is an eminently readable and interesting book and the illustrations are extremely good.

T.R.F.

Les Blés Tendres Cultivés en France. PIERRE JONARD. Institut National de la Recherche Agronomique. Paris. 1,600 fr.

French varieties of winter wheat are widely grown throughout the southern half of England, and their use has increased since the end of the war. M. Pierre Jonard described and classified the French wheats in a volume published in 1936, and this new book, published in 1951, containing nearly 500 pages, brings the description of varieties inscribed on the French official list up to 1949. The text is, of course, in French.

The descriptions apply to field and physiological characters such as resistance to disease, as well as to the points of form and structure by which the varieties are identified. This is an extension of the previous work and it enables the grower to form some idea of the value of the varieties for particular conditions. The British grower should be reminded, however, that disease resistance is not always the same in France as in England.

The great value of the book for British readers, however, is in the description of the various diagnostic characters and the classification of the 137 varieties now included in the list. The description of the diagnostic characters is very well done and is illustrated by clear drawings, particularly of glumes.

M. Jonard has been the leader in this field for many years, and those who know the older work will find the standard well maintained in his new book. There are few other countries in Europe so well served with such an accurate description of the varieties they list. Reference to particular varieties is simple, apart from an error in reference to the plates in the alphabetical index. The book is well printed and attractively bound, although cream is not the most serviceable colour for the cover of a reference book.

It is almost certain that this book will remain a standard reference for those concerned with wheat varieties in Europe for the next ten years.

E. G. T.

A Sanctuary Planted. WALTER J. C. MURRAY. Phoenix House. 15s.

There are two methods of approach to this book. It may either be regarded as a piece of research (as yet incomplete) into the association of wild animal and plant life, or it may be looked upon as literature. Those who have time to spare may enjoy reading "Oh, my Redwood and my Wellingtonia, what floods of events will Time in wave after wave release about your columns?"; but for those who may wish to use the book as a guide to establishng their own sanctuaries, I am afraid it has little practical value.

The book tells the story of the hard and unceasing labour which went into the creation of Mr. Murray's own sanctuary in Sussex, and purely as a tale of endeavour, it provides some very enjoyable reading. But the narrative is incomplete and misleading in many respects. Thus it would have been greatly improved by the inclusion of a proper plan showing plant names and spacing. I would also quarrel with the author's attitude towards the control of both wild flora and fauna within the sanctuary. It is, he said, "the rule of the sanctuary that all are welcome unless and until they become a nuisance". In fact, it is often impossible to get rid of pests once they have been allowed in: they must be excluded from the start.

Two useful appendices, listing plants and animals in the sanctuary, are given, but it would have been helpful to beginners in selecting plants if the normal heights of shrubs and—more especially—of large trees had been included in the first appendix. It would also have been valuable had the author listed in either appendix the names of trees and shrubs preferred by nesting birds, and of berries and other fruits eaten by wild animals. Again, while evergreens have been distinguished from broad-leaved trees and shrubs, a number of evergreens, including *Aucuba japonica*, *Berberis Darwinii*, and *Sargentiana*, and *Abies nobilis*, have not been indicated as such. There are several errors, too, in the spelling of botanical names, which should be corrected in a second edition.

E.L.

The Use of Electricity to Increase Soil Temperature. E. W. GOLDING. The Electrical Research Association Tech. Rept. W/T 26. 9s.

This is a reprint in the form of a technical report of a paper which was originally presented at the Thirteenth International Horticultural Congress, 1952, and subsequently published in the Report of the Congress. However, the diagrams have been redrawn and they are very much the better for it.

The report summarizes research by the E.R.A. on soil warming and soil sterilization, dealing particularly with the physical principles—the temperature and energy relations concerned in the application of electrical energy to soil, more especially with reference to types of electrical equipment now in use. Its object is to show what temperature conditions result from given energy consumption under a range of controlled conditions of use. It leaves to others the question of the effects on plant growth and of optimal relationships with cropping.

R.T.P.

BOOK REVIEWS

Dry Rot and other Timber Troubles. W. P. K. FINDLAY. Hutchinson. 25s.

Dr. Findlay, who is already well known for his work at the Forest Products Research Laboratory and is the author of numerous papers and the joint author of several books on decay in timbers, has given us in this book a very valuable addition to the literature of wood technology. In it he deals with deterioration in timber caused by agencies other than fungi, including damage by the principal wood-destroying insects met with in this country and by termites, destruction of wood by such marine organisms as gribble and shipworm, mechanical breakdown and chemical disintegration. The author touches briefly on the chemical components of wood substance, stressing the greater susceptibility of the cellulose to fungal decomposition, and pointing out the importance of certain extractives as natural preservatives. It is a pity that more information on the latter subject, based on actual research by Dr. Findlay and his colleagues, has not been included, but doubtless the need to limit the size and price of the book precluded it.

The chapters describing the various species of fungi, the types of preservatives and the methods of application are more than adequate for the ordinary reader and indeed for the student who is not specializing in a particular branch of wood technology. The eradication of dry rot has been dealt with efficiently, and this is very appropriate at a time when so many buildings are infected. There is a chapter on the treatment of timber used in agriculture and horticulture in which stress is laid on the economic importance of such treatment. In discussing protection against fire, the author omits to mention one very recent kind of surface treatment—that of coating the timber with a substance having extremely high heat-insulating properties.

The publishers deserve a word of praise for their part in the production of this book, for the type is very pleasing and the paper good—as indeed they should be to complement the high standard of the subject-matter.

H.A.C.

National Institute of Agricultural Botany 33rd Report and Accounts, 1952.

The importance of the activities of the N.I.A.B. is reflected in the improved staffing complement granted by the Ministry of Agriculture during the year under review. This had made possible the appointment of specialist officers to deal with the growing ramifications of the Institute's work. The existing branches (namely, Crop Improvement, Seed Production and the Official Seed Testing Station) have now been augmented by a branch concerned exclusively with potatoes.

An additional regional trials centre (making 13 centres in all) has been set up at the N.A.A.S. Experimental Husbandry Farm, Trawscoed, Aberystwyth, for testing crop varieties under rainfall conditions typical of an important region of Wales (40–50 inches a year). Arrangements have also been made to test under fresh soil and climatic conditions and at an early stage varieties bred at the plant breeding stations at Edinburgh, Aberystwyth and Cambridge. The first of an intended chain of centres is now established in the south-west at Seale-Hayne.

A new departure in the check inspection of crops under the Approved Merchants' Scheme, by which merchants are invited to accompany N.I.A.B. officials when they examine crops in the field, is being tried out. Though this takes longer and so reduces the acreage that can be covered, it is believed that its educational value is likely to bring considerable benefits over a period of years.

In cereal inspections, an analysis shows that the main causes of rejection were twofold–contamination with other cereals (34.8 per cent) and by weeds (32.5 per cent)–indicating the need for paying attention to the previous cropping when selecting land for crops to be grown for seed.

The general extension of the Institute's work is again in evidence in the plans which are under consideration with the seed trade to set up a comprehensive certification scheme on a national basis for herbage seeds, and by the steady growth of participants in the Approved Merchants' Scheme since its inception in 1947. In that year 26,808 acres were inspected; in 1952, 57,772 acres.

Details are also given in the report of the performance of a large number of varieties of cereals, root and fodder crops (including fodder beet) and vegetables in trials carried out at N.A.A.S. Experimental Husbandry Farms and other centres. Among the cereals, the spring barley, Proctor, appears to be outstanding and is now included in the Institute's *Recommended List of Cereals for* 1953. A copy of the annual report can be obtained free from the Institute.

A.J.L.L.

The Production of Barley for Malting (Monographs on Malt and Malt Products). Muntona Ltd., Bedford, and Edward Fison, Ltd., Ipswich. Free.

This most interesting booklet should be read by all who wish to be abreast of developments made in the production of malting barley in the last fifty years, and of others that await immediate confirmation in agricultural practice. Issued, as it is, by commercial interests concerned in the manufacture of barley-malt products, an outstanding feature of the text is the recognition of the close association that should exist between the producer and user of barley grain. In the past we have grown accustomed to hearing a great deal about the virtues of certain kinds of foreign grain. Here at last, however, is a well-merited tribute to the native product, and an acknowledgment that it is, by nature, capable of supplying all the raw material necessary for the diverse commercial operations for which these islands are famous.

A feature of the booklet, as its title implies, is a collection of admirably concise notes on the cultivation of the crop. These are prefaced by an equally concise definition of the maltsters' requirements, and the two together cannot fail to furnish the guidance that is intended. As might be expected, there are points that require qualification. For example, under " Choice of Seed " it is stated that the nitrogen content of seed should be about 1.7 per cent: but if high nitrogen content in the seed is a criterion of high tillering, double that amount would be still more desirable. Again, there is a general impression in the text that low total nitrogen and low grain weight are inevitably associated. Although this may often be the case, it is by no means an invariable condition, for at times high grain weight, high yield and low total nitrogen are found in association in the grain.

At a time when certain foreign varieties are becoming increasingly favoured by British barley growers on account of highly desirable agricultural features, the observations on the comparative malting and brewing value of native and imported barleys are particularly apposite. We are told that the Scandinavian varieties, like many six-row forms, contain a higher proportion of insoluble nitrogen than their British counterparts, and that while an excess of soluble nitrogen may lead to a haze in the final beer, too small a quantity will result in other brewing troubles. For this reason, the advent of newer varieties derived from crosses between the Scandinavian and some of our native sorts possessing qualitative characters in line with most British brewing requirements, is a matter of special importance in malting barley development at the moment.

The booklet is to be commended for directing attention to certain limitations imposed on the plant breeder in his efforts to align improvements with the necessities of the hour, but the opportunity is there, and new lines of experimental approach indicate the possibility of continued progress.

It is interesting to note that the burning questions of combine harvesting and storage are dealt with in another booklet of this series of monographs.

Three appendixes, dealing with many aspects of malting barley, complete this highly informative compilation.

H.H.

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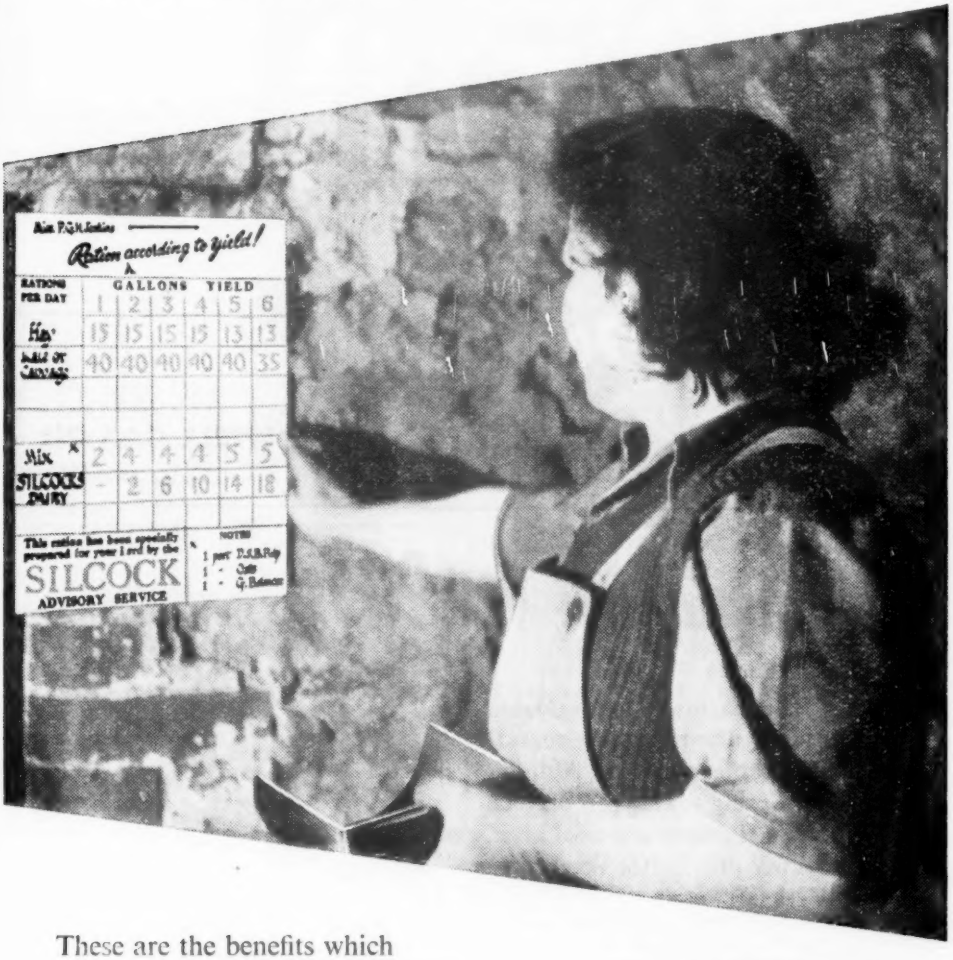
(16) Ps.35 20D/40 K/97 1/54 SP/TBH **Gp.521**

(1) Herd average: 216 gallons per cow UP

(2) Food cost: 1¼d per gallon DOWN

(3) Milk sales: £756 per annum UP



These are the benefits which Miss P. G. H. Jenkins, Channons, Silverton, Devon, has derived from four years of rationing assistance by the Silcock Advisory Service. Last year her 21 cows, running on only 44 acres, produced almost £3,000 worth of milk!

SILCOCKS
DAIRY FOODS

General view of one of the analytical laboratories at the Walton Oaks Experimental Station, the Research establishment of Agricultural Food Products, Ltd.